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PROGRESSIVE
EMBALMING
SCIENCE.

Illustrated With New Methods

—OF—



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Embalming Surgery.

Embalming Necroscopia.

Embalming Bacteriology.

Embalming Chemistry.

And a Brief History of Diseases Ending
in Death.

BY W. W. BALL.

Author of several Essays on Embalming, such as Rapid Dissolution,
Anatomical Chart and Guide, Elementary Treatise,
Published in the Casket in 1883.

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Letter.

In presenting this work upon the subject of Progressive Embalming, the author desires to extend his most cordial thanks to the embalming profession for their many kindly considerations in the past, and also to all those persons who so graciously and kindly extended the free use of their Medical Libraries, which in so many ways assisted the author to gather notes and sketches of the subject matter that was shown to be in any way related to one or more departments of the embalming art, and while it is true that these favors have been varied and mingled through the period of some years back, yet the same obligation and the same gratitude remain to be extended by the writer for the helping acts and kindly advices of such as Dr. Furgerson and Mr. G. W. Rowe, Michigan; Dr. Ross, of Washington, D. C.; Dr. Kern, Prof. Scott, M. D. Ph. D., and the late Dr. Johnson, of Kokomo, Ind.; Dr. Vaughn, of Dixon, Ill.; Dr. J. M. Austin, the Warder Library and others, of this city.

In the department of Embalming Surgery there are many important illustrations drawn and revised; the author's varied acquaintance and experience, which in many ways has enabled him to illustrate many important embalming operations—and what relates to that of surgery has been attained through the special study of such authors as Hamilton, Agnew, Smith and Howe. While it may not be out of place to say these embalming experiences have been continued in a varied way beginning in 1872, as a cabinet-maker, undertaker, funeral director, embalmer, and since 1881 as a special student of the art, and this coupled with an extensive and wide acquaintance with so many of the advancing minds of those en-

gaged in the work through the country, leads the writer to believe that all pertinent points of practical and progressive embalming operations are so plainly given as to lead the student to a practical knowledge of all that which pertains to an honorable and more professional advancement of the art, and in the meantime may not only encourage them in doing this work, but lead them to rely upon their own thermal and specific observations of what relates to Putrescing reagents.

And yet to go still further, in order to lead to a more practical knowledge of body condition, I have appended a brief history of *Death Causes*, and this obtained through association and study of Clinics and that of morbid Pathology drawn from Virchow, Flint, Dunglison, Hartshorn, Dunlap, Taylor and other works like Gray and Dalton, while in the department of Bacteriology and Microscopy, Hunter, Pasteur, Liebig and Carpenter.

And last, but by no means least, the study of *Embalming; and Anti-Sceptic Chemistry*, from F. Ruysch, Hunter, Gannal, Falcouy, Renouard, Bell, Richards, Sullivan, Hohenschuh, Perri, Lewis, Holmes, Hussey, Sharrer, Barnes and the American embalming pioneer, Hon. J. P. Eppley and J. M. Sampson.

The Casket, Shroud, Sunny Side, Western Undertaker, Rock Falls Undertaker, and The Embalming Monthly, and also to that which is due to the lasting name and memory of those like Benjamin, of Saginaw, Mich., and all other persons who by their tireless work brought forth the stately ship of state and international co-operation—and now what is herein, is briefly given as the humble part of the writer with a sincere hope that it may be found of no disparagement to the names we have used and may be found consistent with the ethics of both the medical and embalming profession.

Most respectfully,

By W. W. BALL.

February 20, 1895.

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TYPOGRAPHICAL ERRORS.

Prof. Renouard's name is spelled wrong on pages 17, 19, 39 and 75.

Prof. John P. Eppley's name is spelled wrong on page 16.

Prof. Perrigo's name is spelled wrong on page 4. Popliteal, on first page of index.

The word wholesale should read "unnecessary," page 13.

The word indulgent should read "intelligent," page 13. There are several over-long paragraphs that read badly because they are not properly punctuated.

The word prognosis is wrong, page 26.

On page 71, after figure 23, should read—"Shows the Illiac artery and vein as it may be found and raised above the two lower femoral operations, either one of which may be used as described.

The second line on page 164 should read—the flesh substances take up most of the "flesh juices by capillary affinity and so the **flesh cells absorb these flesh juices**, by the colation of the fluid molecules with the flesh cells. Also 3d line, 2d paragraph, "as it seems that certain parties are claiming may be done.

The word Oleine on page 33 is spelled wrong.

Introduction.

While preparing this pocket manual on the subject of embalming the author finds that each of the subjects which he publishes in the following pages are subjects which should receive more attention than the limited space will grant, and these, like several others which he has written and published since 1875 or '76, including Ball's object lesson chart of 1881, and the embalming treatise published in "The Casket" in 1883, will also not be free from errors, and moreover what defects this book may have, the author does not concede that it is necessarily a fault that is small; however, it has been his plan to simplify many of the intricate problems of the embalming art, and in this undertaking there are several plans designed which involve instructive lessons of embalming methods of surgery, and its relation to the art for supplying chemical reagents, and so to more fully provide ways and means by which to meet that which follows so closely after the fatal tendencies of innumerable diseases. As the embalmers become more cognizant of these facts which present themselves each day anew, so also they see the necessity for a more replete knowledge of special departments of the science of anatomy, physiology and chemistry, as these studies are each allied, to give us methods and processes for embalming, and so while we undertake to shorten and simplify so great and important studies as these, we are compelled to drop out so much of that which would take the student to the higher knowledge of that science; but the author has foreshortened all in order to simplify this art, and hopes, nevertheless, that he shall be able to give practical and terse lessons which may enlighten them. and so lead to such knowledge as now required, for their true professional advancement.

In the department of embalming surgery, he has purposely avoided the names of many muscles, nerves and bones, as these names would only confuse the student in learning the proper names and localities of the arteries and veins, together with a knowledge of ways and means for performing the more important operations which may be required of them.

Inasmuch as a great part of this work is similar in detail to that of the surgeon, we have made a new application of such surgical illustrations as are best adapted to show the most intricate operations of embalming surgery. There still remains for us, many new responsibilities as specialists, because of the new applications, of these sciences, by similar operations which I combine, with modes of my own and others, in order to compile new and fundamental principles into plans and methods, by which to build up the art of embalming, whereby all the new requirements of this profession, may be better dealt with by all earnest students of the profession.

While the embalmer cannot follow or either pattern after the doctor, there is much which can be learned of them, since all their professional work has taken the form of an exact science, Embalming should become the same, and if we make the first step more perfectly and securely, we will find that every single act which in any way pertains to the work of our profession should be reduced to the exact detail of everything which surrounds that work and may thus be shown as professionally required from given causes. No matter how simple may be this detail, yet it may at sometime lead us or others to the more exact observation at some future time, and by this means may also lead others to a higher scholarship, and what may be found as being useful, no matter when we get it, let the history be both true and specifically detailed, for this will not only aid us to become good scholars, but it may tend to build up this science. In the meantime, what we learn from medical, or any other classes of books, let us give due credit for the source of knowledge. If from some among our own profession, no matter how remote from special favor this may be, let the observation stand by the light of its own truths. By this same rule let us not loose sight of those who carried the beginning burden of that service which, though now past, should be given the due acknowledgment according to what that first service may have merited, as the first steps toward bringing out those principles and methods which have advanced our new profession to the present dawn of theoretical and more practical embalming.

AUTHOR.

Professional Interest.

Perhaps very few modern undertakers know that the time has come when those who would become embalmers must run their race, as it were, with the medical faculty, and to cite you to this fact, we will state in the author's own words what has been published to that profession.

Dr. Benj. Ward Richardson, after contributing an excellent article upon the subject of ancient and modern embalming to the "Woods' Monographs," of September, 1889, says, in the closing chapter three: "I have dwelt for a few moments on the details of embalming, without minutely arguing any point that may be raised upon them, in order to show that the art is one that is *demande*d on various grounds and is *not likely to fall out of demand*. As this is the undoubted fact, I think it is right for the medical men to retain and even cultivate the most perfect knowledge of the art. If we do *not scientifically carry it out* other men, mere empirics, who know nothing of either chemistry or anatomy, will attempt to do so, the public will be defrauded and an art, which really rests on the present basis of science, will be brought into unmerited disrepute."

He says further: "There is nothing so difficult in the process but that any practitioner can perform it as easily as he can perform a post-mortem examination; and when he has before him the simple rules I shall lay down in the next chapter, he will find the task easy. One quality only does it call for, and that quality is patience. It is true in these days we are rapid to a marvel when we compare ourselves with our old friend, the Egyptian embalmer, for we require hours where they required days. But still to do the thing well some considerable patience is demanded even now, notwithstanding all our modern knowledge and modern appliances."

It would appear from the wording of the above paragraph that the doctor fully believes that his profession must yet become the embalmers of the country, and while that may be the case in England, his own country, or some other countries like France, and Spain, but it will not be likely that any profession other than the skillful modern funeral director will perform the work of embalming the dead in America, especially in the United States, simply because the work of embalming belongs to those who professionally conduct the funerals according to the customs of modern burial rites, and

while it may be true that the science of anatomy and chemistry belong to the medical profession, but today the embalmer is rapidly becoming fully equipped with such knowledge and culture as to place him far above the name of professed pirates and by all rights should stand on a fair professional footing, and, as for our part, we are in favor of giving the medical fraternity all the credit due them for the many practical embalming ideas from their books of disease, as well as from the completeness of anatomy, chemistry and surgery, for it is true that nothing could ever have been accomplished without these sciences. But now that we take this and proceed with so many intricate methods of advancement, by which to successfully meet that force of conditions and circumstances which are to be met at every hand while doing this work, they should know that embalmers are specialist, and as such they are entitled to a consideration in keeping with their honorable and professional accomplishments. What our profession in the past has done is only the work of a beginning, and it is true that we have borrowed much of our sciences of method and process from the medical profession, but there is yet no small science which we must supply, and this is in creating ways and means by which to meet the public requirements as they present themselves so differently from day to day. What has been done by the embalming profession here in the United States, has already become well and favorably known and so acknowledged, and this establishes the fact that the modern funeral director as embalmers, are fast becoming qualified and able to perform many if not all the duties which the public may require of them as necrocedia specialists.

Embalming Jurisprudence.

There are so many times when the embalmers may be at a loss to see from the outward appearances of the body what was the actual cause of death, and for a time he may be at a loss to know what is best for him to do under the circumstances. But in the past this has often been the case with our best physicians. The doctors' knowledge of diseases, and the various consecutive derangement of the body has grown by the slowest steps of observation and experience.

Experience shows that embalming progress, like that of medical science, rests upon the common laws of cause and effect; therefore our intelligences are appealed to for better methods by which to supply various remedies to offset the many dangerous forms and consequences which follow diseases. Upon this ground the physicians have been given many valuable supports by a legalized statue which enables them to prove all advancing theory by the simple method of observation and a final investigation, so they may become familiar with every detail of those things, which by disease or other reasons may have become more or less disastrous to their methods of treatment.

Perhaps the most perfect system for advancing the physicians to a complete knowledge of diseases and the various stages of complication, has been as we have said, the statutory law, which legalizes post mortem examination after death. While they are so especially favored by all but the unlimited methods of procedure, which they direct according to their own theory, even to the extent of an experiment. Yet there is none who can not but acknowledge the untold benefits which these men do give by work for humanity in return for this international statute law, that both protect the public, while it encourages them as professional men.

Inasmuch as the modern embalmer has become the public servant, and this as a scientific specialist, it now becomes necessary for that profession to have a specific law. Not that the embalmer is to be classed as the physician or surgeon, but it is because the public requires certain intricate professional services which demands of them a more perfect knowledge of the internal disarrangement of deceased bodies as they become involved by reason of the varied destroying influence of "Death Causing Diseases."

The question has been asked, who is to become the future legal embalmer, and if we consider the future safety of the public can anyone, other than a cultured student of medicine and surgery be permitted to hazard the work of empiricism as against those who have a qualified knowledge of the high science of chemistry and art?

Now this is a question which is not yet a settled matter, further than what silence has given over by the laws of custom, and as there are known to be, not a few abuses which are beginning to chafe these customary silences, so that in some localities public opinion is fast becoming waged into the form of a demanded statue to govern and regulate the practices of those engaged in this art, as well as for that of the druggist or the doctor.

As intelligence and good meaning can not make either a good druggist or a good doctor—neither can it qualify the undertaker in the professional work of embalming the dead.

Admitting the two grand features of these professional qualifications, yet there remain alike proportionate responsibility, and while the doctor's studies have qualified his knowledge to the extent of his being a safe, competent druggist, or even a competent embalmer, the same can not be said by reversing either of the two last with the first. However the druggist may become better qualified by the study of a single science, and so it may be with the embalmer also. And when we consider the undertaker we find it proper, by reason of his surroundings, that he qualifies as an embalmer, and do this by the special study of that science. And admitting that the doctor may possess every requisite which would enable him to do good embalming, they ought not undertake to possess the whole earth, but should confine themselves to

the study of practical medicine, and not confuse himself with that science which may give practical drug remedies and reagents for correcting an uncalculated putrescence—for this is the work which must be accomplished by those who study the special sciences for better ways and means of embalming the dead.

Experience teaches the most practical lessons of life, and it is through this that we find that all method and process for the embalming art can only come through a cultivated plan of advancement. And now since the public requires the services of an embalmer, and it is found that this service must be a practical professional one, then there is sure to be a reasonable qualification, on the part of those who are to engage in this new work, and provisional laws to govern and regulate that work according to what it merits and requires. What this profession may do, remains a matter yet to be more fully studied, notwithstanding the rapidly grown public favor. But what the profession requires as professional men, is a statutory privilege which will permit them as profession men to become investigators and so prosecute the results of observation to the proof of proper theory; this only can advance them to a better knowledge and so provide better ways and means by which to enable them to more fully understand and master many of the intricate tendencies of rapid, morbid and poisonous stages which are to be met with in handling the bodies of deceased persons. Nothing less than some well regulated ways for proof can ever settle any theory or observation to a knowledge of fact, and so personal investigation will be required if we would have the embalmer to advance his knowledge in keeping with the demands of the public. Then a legal post-mortem inspection should be granted under certain professional restrictions, when in the meantime these men as specialists may be enabled to broaden their knowledge by enlarging the field for discovery and so ultimately cultivate and build up the embalming art to that of a more exact science.

Special Science Advancement.

Past observations show us that with modern embalmers there is a great deal of empiricism, but this is no more truthful with us than it was with the doctor's fraternity not many years ago and as legislation has helped to build them up so it will help to build up the modern embalming profession and to cite the doctor to the fact that here in the United States we have the true spirit of an honorable professional advancement. We may only point to our numerous State and International associations, and especially to those like Virginia, Alabama and others whose leading representative men are alive to the public good as much as for the professional interest and so by their united efforts as good citizens to stop all nostrum and empirical fakes as soon as possible. The author will venture the assertion that all embalm-

ing fakes will be stopped before the medical profession can stop the practice of medical quackery.

But to return to the subject, Dr. Hartshorne says that it is the vocation of the true physician to make all observation scientific and this being the only true way for any professional to succeed, shows us that the embalming art, also, must be made and cultivated into the most precise methods and ways of practice. To do this rightly all must study and learn to appreciate the conditions and circumstances which modifies the action of drugs or chemical reagents, as well as to know what stages of putrescence may or may not require, as they are separately or collectively placed in contact with various morbid substances which the long lines of various diseases leaves for the art of modern embalming to remedy afterward.

And we will say that here is shown the task that within itself embodies more than is now known by any specialist of the higher branch of any science; therefore, we, as embalmers, must go forth upon the field of discovery which alone may yet result in a better system and methods by which to guide each practitioner in the beginning work of daily observation.

Is it not true that embalming is a progressive science? and we may say with all due respect of propriety, that even an incomplete knowledge of the internal physical condition may at some time suggest some safe and proper experiment. However, the better plan for the embalmer's true advancement will be found in the study of every associate detail of such branches of the established science as are likely to give us a better knowledge of all that pertains to embalming.

After physiology and chemistry, comes the greatest study of all, morbid pathology, or to be more specific, we must become thoroughly acquainted with all the physical conditions as they result in death by reason of any and all diseases. For if the embalmer would be a man of acknowledged professional ability, this standing must come from the success of his work as well as by what show they may be able to give. And in order for them to be expedient and exact, they must become good judges of the actual internal condition of each subject and when they fail to find some proper outward signs, they must know ways by which to prove the exact internal disarrangement which diseases or other causes may have created to the embalmer's disadvantage.

Then to discuss this subject further, we will say that all good diagnosis will rest materially upon the operators knowledge of, first, the chemistry of the human body, and next on that of his thorough acquaintance of what disease will cause by either local or general morbid condition and varied by the same rule of all those maladies which result in death.

Now, as the history of all diseases are studies of the highest sciences, so, also must come the embalmers science because we must take and operate upon, not a single substance with but a single form, but it is with various flesh substances, which under

the advanced stages of putrescence may scarcely have a form and so lose the normal one by becoming a mass, lost by reason of the disarranging process of disease.

An embalming formula or receipt may be useful in certain specific instances but as we gather experience, we see that nostrums must be treated as such, and now we look about us for true operative methods as well as for embalming compounds.

The embalmer's experiences for the last twenty years show us that there must be practical methods of operative surgery, as well as practical reagents, to meet the crying necessities, for past experience has taught all that when there is no certain knowledge of a thing, a mere opinion can not discover a sure remedy; what may prove useful in one case may be a detriment to another. The time is here when all embalming should be conducted upon the rational laws of cause and effect and thus to draw out new methods from the evident causes so that all obscurity may be removed from what pertains to embalming as a science.

Then, when we look into the future prospects of the coming professional embalmer, we will see that the question of the seat of disease; the class and process which a malady may produce are questions of no idle talk, because we know that no one can do good embalming by the single arterial process alone, when at such times there are ruptured arteries, engorging abscesses or some similar condition like abnormal growth and other hinderances.

Since we know that each one of these affections may cause such a physical disarrangement, and therefore will require special operations as well as special drug reagents in order to cope with the destroying influences with true measures of embalment.

It is this knowledge of the embalmer's work which has brought the writer to the conclusion that the time is here when all intelligent embalmers want to know "the why of the rapid and unaccounted for putrescence" and the how shall they apply embalming surgery and chemistry by which to successfully control and embalm that class of diseased bodies which will not yield to any ordinary mode of treatment.

Since it is true that neither formulas nor mysterious drugs will meet the present professional wants, the author will say that nothing less than a special study of the special science of embalming can or even will supply a way, but by that of a thorough knowledge of the many intricacies of this science. When each student will carefully study to know the many forms of rapid dissolution of the human body, they each may learn what will be the varied predominate causes for the dissolution and will sooner or later find ways to explain all as well as to be able to understand how it is that true chemistry is built upon given laws so that each drug may be known and classed upon the fundamental law principles which create each into classes according to their primary bases, and as each one of these may or may not be organized or reorganized into other compounds whereby we may find specific embalming qualities under given conditions or if

otherwise, we may find specific embalming qualities under given conditions, or if otherwise, we may be enabled to determine why, and this by the same rule which chemical science provides and establishes medical remedies for doctors use. Then why not for the embalmers, also? Though we admit that the living functions of the human body are vastly different than when under the influence of decay.

And so the author has prepared and believes that the profession wants a brief work upon the history of the diseases which, separately or by their various complications, end in death.

By the side of this we have also compiled and illustrated the various surgical operations, which the embalmer ought to become thoroughly acquainted with, because this knowledge will enable him to select and operate according to the requirements which a knowledge of death causes, and his experience together will show as being necessary in order to do all the work as it should be done. No one can make observations nor pass opinion of any reliance or consequence until they have some true knowledge of these things by which to base their judgement upon.

We presume that there will be some persons who will raise objections to this book of surgical operations, but we do not expect that question of wholesale mutilation of the body to be raised by the indulgent people, but only those who have a design. And I may say that it is not necessary to make either exposure or mutilation of the body of any subject for the skilled hand of the modern embalmer can and will operate only as justified by the **actual requirements** of each subject and this in the same ratio and with the same spirit as the most eminent surgeon when they carefully and thoughtly administer the many untold benefits of that science as an achievement for humanity, since method and culture are shown to be their only reliance, and so it must be our constant care to be cautious and thoughtful as professionals while we act as the servants of the public.

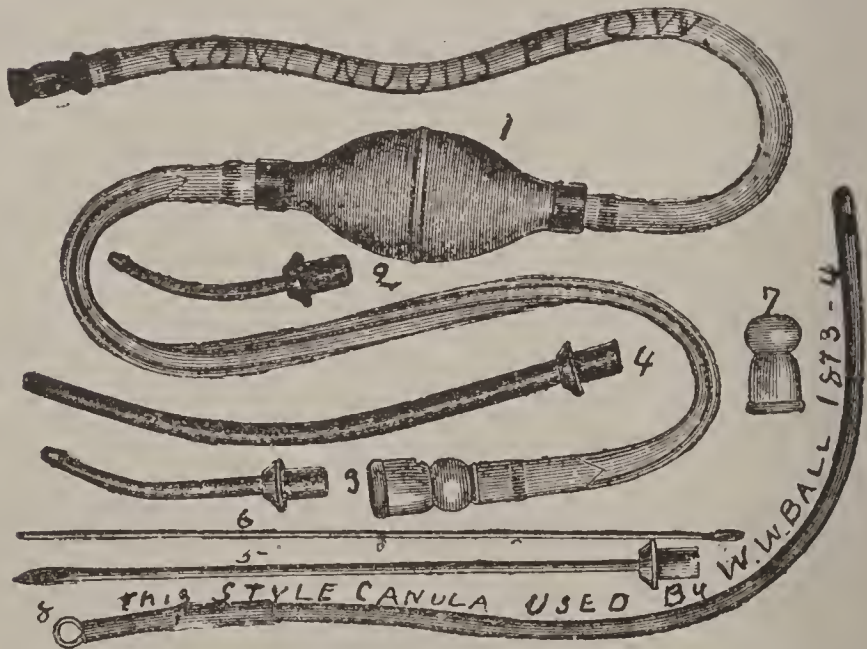
Embalming Instruments.

There are now many classes and grades of embalming instruments on the market, and as these vary both in price as well as in style and quality, it will not be necessary for the author to speak of them further than as they relate to those instruments that are actually necessary to enable an intelligent operator to do good work. However, no person can be a good operator unless they have studiously applied themselves to the well known sciences of the modern embalming art.

The embalmers' postmortem and dissecting instruments are usually simple, yet they should be made of good material, and if not, they soon become useless.

- No. 1 shows round point scalpel.
- No. 2. Abscess scalpel.
- No. 3. Tenaculum.
- No. 4. Fastening or pinning chain.
- No. 5. Round edge scalpel.
- No. 6. Parting blade.
- No. 7. Pinchers.
- No. 8. Rib or bone shears.

Embalming Syringes.



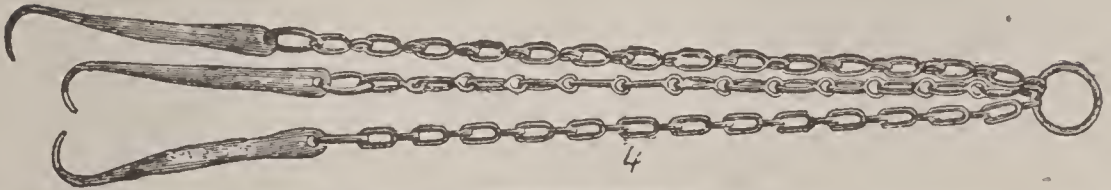
Cut 2.—Continuous Flow Syringe, Artery Tubes, Needle and Canula.



2.



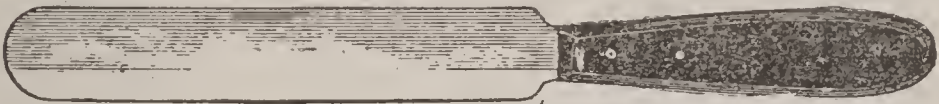
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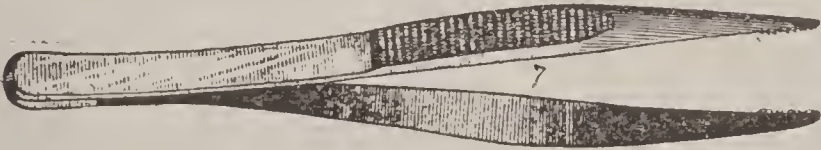
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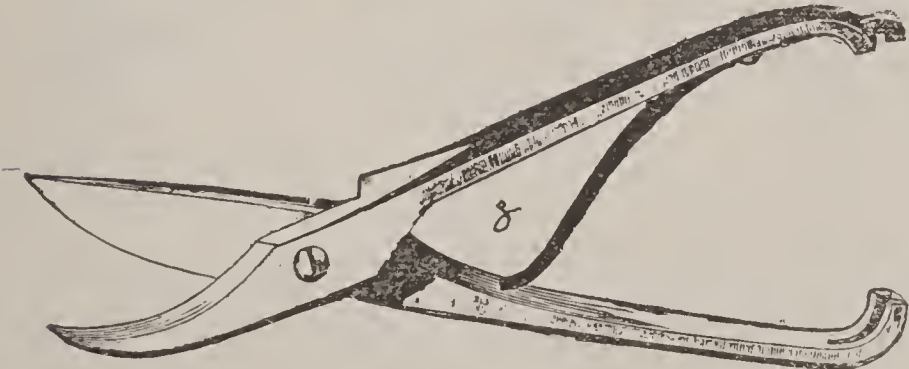
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6



7



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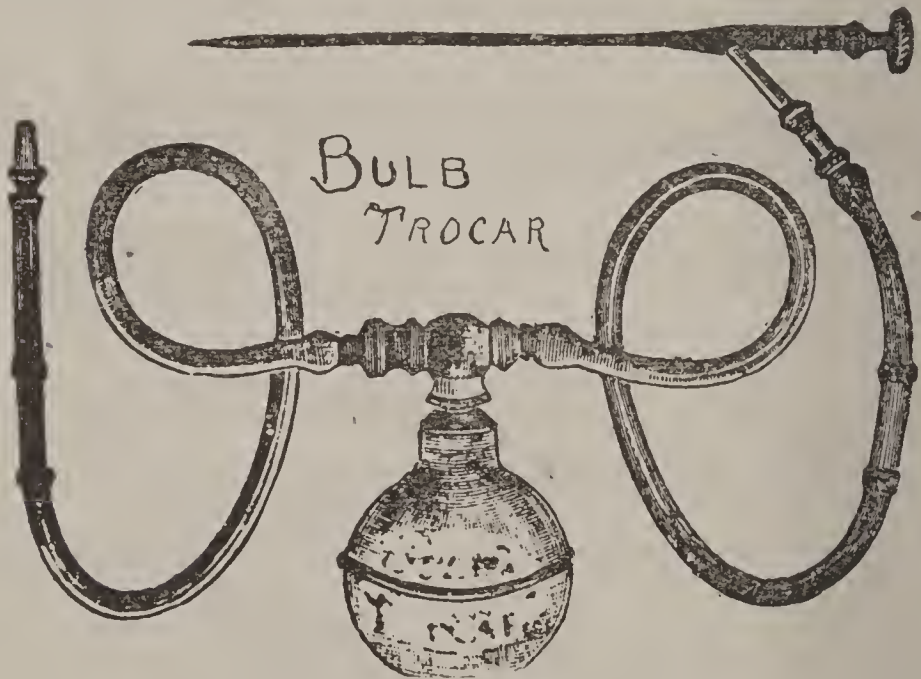
Cut 1.—Embalmers' Postmortem and Dissecting Instruments.

All professional embalmers should provide themselves with a well selected general case of embalming instruments, and the assortment ought to be made up from a good variety, and should, for professional use, include not only a good hand satchel, but comprise one or more special pocket cases.

Any strong rubber or metal syringe will do for ordinary work, but it will always be safer to purchase one that is especially fitted with valves for this class of work. Cut 2 shows an illustration of a continuous flow syringe called the "Omega Embalming Syringe." Figures 1, 2, 3 and 4 show curved artery points or tubes. Fig. 5 shows a long straight needle. Fig. 6 is a wire rod which fits into this needle so that it may be used as a trocar point for dispersing and routing the gas. Fig. 7 shows a rubber cap for capping the needle while using it as a trocar. Fig. 8 shows a long canula or soft flexible tube.

Early Experiences.

The author made use of this, or rather a common catheter, first during the fall of 1873, for introducing the embalming fluid into the stomach through the nose. In cases where there was no cavity or arterial process of embalment.



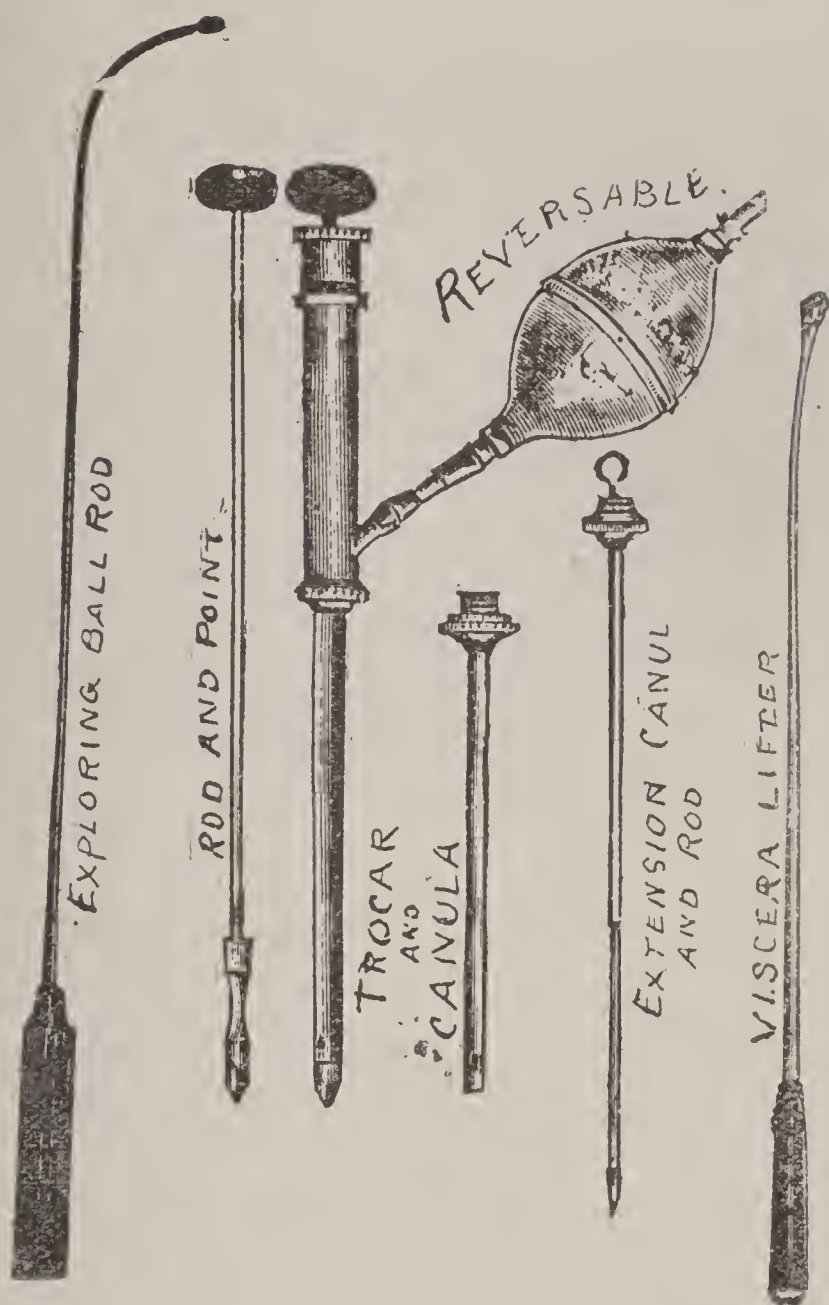
Cut 3.

The embalmer's bulb syringe and trocar for cavity work is shown in cut 3.

An improved trocar is shown in cut 4, page 17. This aspirator is provided with three sizes of trocar points and rod to suit each one, while the patent shank is provided with a reversible bulb. On the right a long soft wire with ball tip and handle. This is used to open up the large veins, while at the left shows a strong exploring rod and viscera lifter.

Aspirators.

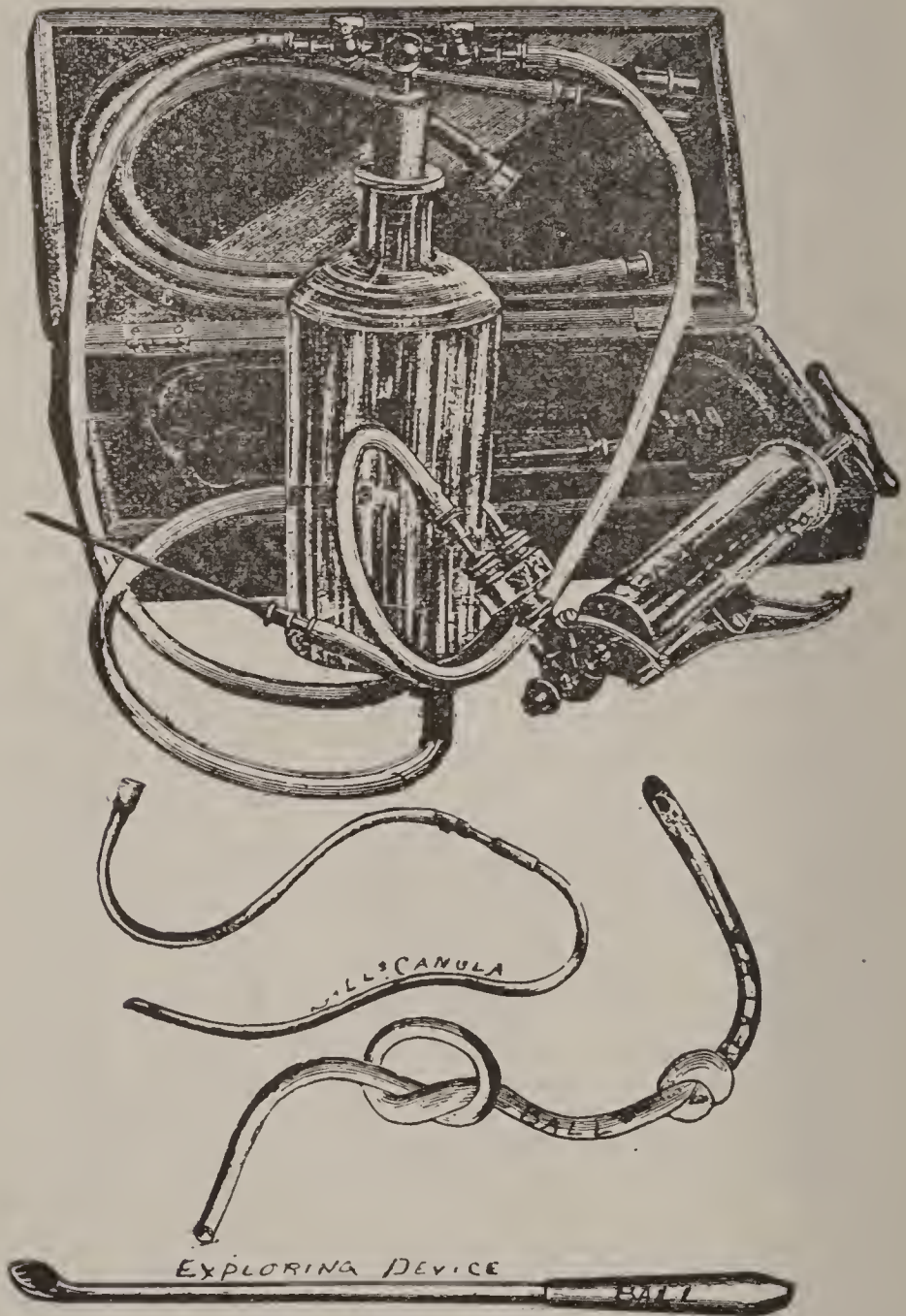
Perhaps the first honor to men as undertakers lies between Hon. John P. Epley, of Cincinnati, O., and Prof. Sampson, of Pittsburg,



Cut 4.

Pa., for being the first to use a metal pump to inject the arteries, here in the United States—as this dates back with the honored veteran, Epley, I am told by him personally that he surgically embalmed a case which he shipped to New York, and soon afterwards made his compound embalming device in 1852

The author first used an improvised aspirator in 1874 (See Fig. 31, page 35)—Renonard, Sullivan and Rhodes, about the same time; do not know the dates of either. However, I think Professor Renonard invented the Y or goose neck, while honors are to be given both for a good many other and similar discoveries for doing professional work, while possibly Prof. Rhodes was first to bring out the long cavity needle.



Cut 5.

Cut 5 shows a large size reversible valve aspirator connected to the bottle with the goose-neck and having the long needle ready for cavity work, for both injecting or ejecting, while there are also various sizes of artery tubes and canula tubes with the case that are not properly shown.

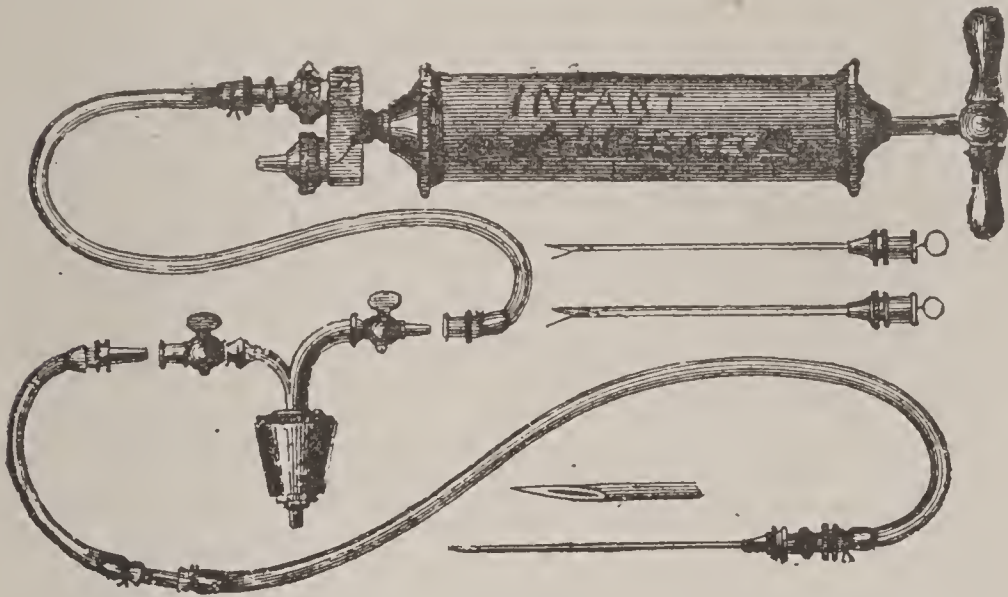
The long canula was made and first used with and without glass connections in 1874.

The Ball exploring device at the bottom of cut 5, also the exploring

rod and the viscera lifter on the right and left of cut 4, are those valuable devices which he has made frequent use of since 1876.

Two special sizes of aspirators for pocket cases are not shown, because they are similar in every way to that shown in cut 6.

For general embalming uses, the aspirator is about 7 inches long over all. While for children or special uses on infants, this aspirator is made much smaller and is provided with suitable and delicate needles and artery appliances which correspond with the professional and delicate work which this instrument is intended for. I believe Renonard was first to use and recommend these special sizes to the profession.



Cut 6.

Speaking of any or all of the above embalming instruments, it will be proper to say that the aspirator and the syringe were each invented by the physician and surgeon, and may have been used by some of them to do embalming prior to the dates spoken of, but as the first steps of the undertaker are those steps which have since brought this business up to a profession as specialists in the work of embalming, we desire to give the credits which are due to all those who set forth in the true work for advancing this profession, and so it is that today we have so many classes and grades of embalming instruments which space will not permit to further detail. Write to your dealer for catalogue.

Embalmer's Anatomy of the Organs of Circulation.—Heart, Arteries and Lungs.

As the human form is dependent upon the staunch bone structure, we find that the anatomist has given latin names to each separate bone so as to signify its function and use. Gray says that there are two hundred bones in the adult skeleton. A good knowledge of the skeleton will greatly assist the student to learn the names of the muscles, ligaments, nerves, arteries, veins and the location of various other organs of the body, but space will not permit giving even an outlining chapter upon the subject of osteology.

While the names of the nerves, ligaments and many of the muscles are of but little use to the embalmer, yet, the deeper we study into all that pertains to a thorough acquaintance of anatomy and physiology, the broader and easier will come a thorough familiarity with the higher and more professional work of embalming.

In order to compile the essentials of anatomy for the embalmers use, the author will recommend a special study as follows:

The Organs of Circulation.—This comprises the heart, arteries and veins and the embalmer should become thoroughly acquainted with their principle branches and sub-divisions, names and location. As these arteries and veins are associated by some principle bone and muscle, it will be found easy to learn their names and structure. It is true that a successful operation may depend largely upon our acquaintance with some peculiar formation of either the bones or muscles, and no one can perform either a quick or successful operation without first having a thorough knowledge of all the intricate surroundings of the vessel or organ which may require any special operation upon.

The pulmonary artery arises from the right ventricle of the heart, carries venous blood to the lungs and then returns as arterial blood through the pulmonary veins into the left ventricle of the heart. *See Fig. 26. Page 77.*

This blood now rises above into the arch of the aorta, partially shown in Fig. 30, page 82, where the blood begins to be distributed above and below. On top of this arch are three branches, each of which are subdivided into various other branches to supply the head, shoulders and arms. The artery innominata is placed at the right side and on top of the arch of the aorta. There

is no left artery innominata. About two inches above the arch this artery branches, and in supplying blood to the right side of the neck and head, the blood passes upward through the common carotid artery. Just under the jaw bone this artery branches into what is known as the external carotid artery and numerous other branch arteries to supply the face, while the deep carotid artery goes above to supply part of the brain.

If we return to the artery innominata, we find the artery branches that supply the right side and arm. This is known as the right subclavian artery. The left subclavian starts directly from the arch of the aorta at the left side. But, to follow the arteries of the right side: A second artery branches above known as the vertebral artery and this at the skull is called basilar artery as it supplies the base of the brain.

Returning to the arch of the aorta, in going toward the right hand we pass the innominata, common carotid and subclavian artery with its vertebral branch as they all branch above, while before the subclavian artery passes over the rib, it again sends off the thyroid axis artery, with its three or more branches above while below the subclavian artery there are two internal branches, internal mammary and superior intercostal arteries, making four branches from the subclavian artery. The next division of this vessel is called the axillary artery, and we find that this vessel has several well-defined branch arteries, also, but their numerous complexions are too great for their full description here.

The axillary artery begins at the border of the first rib and continues to the arm pit where it is called the brachial artery.

The brachial artery sends off three branches and the artery lies just under the biceps or great muscle of the arm, and is said to be superficial because of its nearness to the surface. Just below the elbow the brachial artery divides into the radial artery and the ulner artery. Fig. 5, page 55 shows the palmar arch of the ulner artery.

As we have described the arteries of the right side above the heart, the student will find that to start at the arch of the aorta this time on the left side, that as there is no left artery innominata and the left common carotid artery starts directly upward from the arch, while just at the left of it, the left subclavian artery with similar branches to that, of the right subclavian artery and continued next as the axillary artery and branch, and the brachial artery and small branches, the radial and ulner arteries of the left arm are like those of the right side.

The Veins above the Heart.

Now, as we have the names of all the principle arteries above the heart, we will take up the veins as they are associated with these principle arteries in the upper part of the body.

At the heart and above the right ventricle of the heart the right auricle forms the beginning of the great venous system and as these vessels follow the arteries above the superior vena cava, they overlap the ascending portions of the arch of the aorta, when this vessel branches to the left and in front of these branch arteries of the aorta. This vein is called the right vena innominata. This time we follow and describe the veins of left side instead of right. On the top of the left vena innominata are two small branch veins called thyoid veins. The more important vessels branch directly above and is called the left internal jugular vein. See *Fig. 30, page 82*. While numerous branch veins are associated with the arteries and are known as the internal jugular, external jugular, fascial and deeper veins. See *Fig 29, page 81*. While the deeper branches are known as vertebral veins of the spine, the thyoid and cerebral veins of the brain.

Returning to the heart or rather the left branch of the vena innominata and pass the internal jugular. Here the external jugular and its branches go above as shown in *Fig. 29*. The continuation of the vena innominata to the left is called subclavian vein and this is where the important function of the thoratic duct empties chyle nutrition into the veins whence it goes directly into the heart; but to name the branching veins of the left shoulder and arm will lead to several complications of this body owing to the chain of net work which the superficial veins, and in fact, all veins leading to the throat. The deep veins accompanying the arteries, as the subclavian vein, the axillary vein and the basilic veins; one of the superficial veins branches from the axillary vein and is known as the cephalic vein. This vein and the basilic vein makes a junction inside the elbow of each arm, where the surface veins show many other similar junctions in the hand and forearm. While we began to name these veins from the heart outward to their extremities, the doctor or true anatomist would have traced these veins from where the venous blood collects into these vessels and followed this back toward the heart. The embalmer may take up and inject several, especially the femoral and the radial veins, (*Fig. 22,*) or by using canula may eject and wash these vessels out, but as these vessels are full of valves and the walls are soft, no fluid can be drawn from these unless there is a long rubber tube first inserted into the vessel. A long soft copper or iron wire might be inserted, if provided with a ball tip. The names of the veins on the right side are exactly similar to those of the left, and while there is but one artery innominata, (right side) there are both right and left vena innominata, though, while the left vena innominata is long the other is very short to where the right deep jugular vein starts upward, while the right subclavian, axillary and basilic veins of the arms and the cephalic or superficial vein which starts or branches from the axillary vein and again joins into the basilic vein at the inside of the elbow of each arm, as it lays near the surface, this vein may be operated upon in a great many cases.

The Arteries and Veins of the Thoracic and Abdominal Cavities.

At the arch of the aorta, we began naming the branches above the heart and said nothing about the great trunk of the aorta. This vessel and all other arteries have strong thick walls and hold their cylindrical form, while the thin walls of the veins collapse and sometimes they will dry and glue together after death. The descending aorta passes from the arch and behind the heart and down the left side of the spine. This trunk is called the thoracic and abdominal aorta.

It is said that there may be frequent malformation of the thoracic aorta branches and that numerous false formations may take the places of certain relative vessels. Beginning with the pulmonary artery, (*Fig. 26, page 77,*) we find that the heart is dependent upon both of the lungs and so are greatly allied by the bronchial arteries. Possibly the first and greatest question to the embalmer is that of ruptured arteries by reason of disease of the lungs. The branches of the thoracic aorta and pericardiac, bronchial, œsophageal, posterior mediastinal and intercostal arteries and their branches. See *Gray, page 494,* for want of space.

The abdominal aorta and its branches become so complex that we shall not be able to describe them farther than to say that the two renal branches of the aorta and similar branches from the interior vena cava unite by convolutions in both the kidneys; while both the interior and superior mesenteric artery and the stomach, liver, spleen and pancreas are each supplied with one or more branches from the aorta. As the aorta is the great artery of the trunk of the body, we find a corresponding vein, spoken of above, commencing at the left auricle of the heart, and this vessel lays on the right side of the spine opposite the aorta situated on the left side of the spine. *Fig 29* shows the right auricle but not the left one, as this is situated behind the heart.

The inferior vena cava is composed of soft, flexible walls and full of valves. Sometimes it will be found more than an inch wide, and what is important to know is the manner that this vessel and branches are involved with the kidneys and other organs of the body. This vein and the aorta may become ruptured by some local disease like Bright's disease or some other affection, which, as local causes, may destroy the possibility of circulating any embalming fluid as it should be. When we study each of the branches of the abdominal aorta, we find so many branches and sub-branches that are of the greatest consequence to a perfect embalming process. The author wishes that each class of these veins and artery branches could be named and described as they should be, because of their future importance to the embalming profession.

Below the kidneys the aorta and the interior vena cava each form into two great branches as both the arteries and veins de-

pend downward from a point about opposite the hips. The first two principle branch forms are those about two inches long and known in the artery as right and left common iliac arteries, or if from the interior vena cava. as the right and left common iliac veins.

With both the arteries and veins there are internal and external iliac arteries and veins. The external iliac artery and vein are shown in Figs. 22, 23, 24, pages 69, 70, 71.

We now leave the trunk arteries and veins and their numerous smaller abdominal branches and follow the external iliac out of the trunk at the conjunction of the leg where this artery is known as the femoral artery and femoral vein; while with the last vein there is a superficial branch called the long saphenous or superficial vein.

The femoral artery and vein are vessels well-known to the embalmer as shown in Fig. 22, 23 and 24, above. The lower incision of cut 23 is about where the femoral terminates and is known and continued as the popliteal artery. (*See Fig. 17, page 66.*) As this passes downward to below the knee where it is subdivided into the posterior tibial artery (*Fig. 19, page 68.*) and the anterior tibial artery (*Fig. 15, page 68.*) The smaller branch shown in Fig. 19 is the peroneal artery—a good operation for the larger one, posterior artery is shown in Fig. 20, page 69, while Fig. 19, page 68, shows another at the terminus or the dorsal pedis artery. Usually the veins are to be found by the side of these arteries, and in some subjects that have large arteries and veins may be successfully operated upon by means of a long gum catheter which may be introduced into the large veins of the abdomen from the incision shown in Fig. 16, though in some cases both time and patience may both be frustrated unless the vein is first opened up by means of a suitable ball-tipped rod, and this, like the brachial artery and vein, will yet become very popular for both drainage and cleaning the veins and arteries as well as for injecting the embalming reagents.

The Principal Body Fluids.

The Blood.—The second study will be that of the blood. As this fluid of the body will take two or more forms and conditions, and so follow with various specific forms of destroying influences, and it is now shown by the science of bacteriology that all flesh juices, while undergoing certain morbidations, may soon become a fostering and propagating medium for many varieties of parasitic fungus vegetable and animal growth that are named according to the specific causes that produce them, and spoken of by the author in an essay on the rapid dissolution of the human body pub. in *The Casket*, also Prof. Renonard's first work on embalming some 18 or 20 years ago, and it is true that if we would properly and scientifically treat and embalm deceased bodies it must

be by becoming better acquainted with all that pertains to the stated conditions of the fluid constituents of each body.

The analysis of the blood shows us that when normal it comprises various proportions of substances like albumen, sacchrine matter, fatty globules and water. Arterial blood and venous blood become alike after death, though the capillary attraction of the flesh tissues will usually absorb most of the arterial blood at or soon after death, while the venous blood may remain in the veins for some days after. However, a greater portion of this venous blood will remain in the trunk veins both above and below the heart, and in some cases may cause the greatest trouble.

The Lymphatic System.—The third important study will be the **Lymphatic System**. This is so closely interwoven in the flesh cells and glands, that it becomes of the greatest consequence to all. Here are found most of the fiery elements of rapid dissolution. While there are but few glands and few local channels, which may be named and treated by any special measure, yet the whole body or flesh system are interwoven by continuous chain or network of the lymphatic glands and channels which contain various amounts of the lymph or sweet watery and albuminic fluid.

Mesenteric System.—The fourth study will be that of the **Mesenteric system**. This gives the first process of nutrition to the blood. The chyme, and the lmyph, are said to be almost identical in their constitution, though with varied proportions of the constituents according to the different parts of the vascular system. The lymph is a secretion of a system of vessels and glands for the available purpose of nutrition as it returns its fluid into the vein close to the heart there to be mixed with the blood; while the chyle is a fluid secreted by the villi of the small intestines from the food. This chyle is intermingled with the lmpyh and is poured into the circulation through the same channels.

The thoracic duct conveys both the lymph and chyle fluids into the blood through the subclavian vein above the heart, while the receptacle for the fluid chyle is located above the fourth lumbar vertebra where the numerous lumbar glands are located and the thoratic duct vessel is located just under the aorta and the asending vena-cova. By making a heart post-mortem incision this might be taken up and injected with embalming fluid, or by using Renonards left brachial vein operation, this duct might be injected if under favorable circumstances. Prof. Hobenschuh thinks it might possibly be pumped partially empty of its contents of chyme and chyle; but as this vessel and chyle reseptacle are only small, the venous injection, if well done, should be sufficient. However, we desire to be fully understood here, because the lmyphatic vessels cannot be injected further than what may be forced into the thoracic duct as spoken of by the above method. As the smallness of the lymphatic vessels with their great chains of net work throughout the whole organ and flesh system of the body cannot be injected, and so these lymph

atic fluids of the body are remote and can only be operated upon by and through the arteries, veins and by flesh capillaries anastomosis. Large and sound arteries and veins will usually provide ample ways to conduct the embalming fluid to places where its chemical affinity may impregnate the lymphatic vessels and glands and so arrest the first stages of putrefying process of decay.

When small arteries or diseased arteries and veins will not permit the embalming fluid to pass through them and so cannot reach the flesh cells and glands of the lymphatic, and so the case is soon lost at all times, when there is any considerable lymph or watery fluids that cannot either be withdrawn or rendered neutral by a suitable chemical reagent.

The fifth matter of importance is to be found within the organs of excrements or rather the special organs, such as the kidneys; but as we cannot stop with one organ, we must take up and include all the viscera of both the thoracic and abdominal cavities.

Beginning with the organs of circulation; the organs of respiration; the organs of digestion, and the brain, closely allied with these, comes the great question of the many classes of disease which attack all the various organs of the body and thereby destroy life by the dismemberment of some functional quality of one or more given organ of the body. [See diseases which end in death.]

As we advance it will be found that much of the professional work of embalming is more or less dependent upon some special knowledge of the organs of the body and the diseases which may directly or indirectly relate to each of the various organs of the body because some special operation may be required, and we must know the arteries and veins which reach these organs. While in cases of some specific disease, we must be able to determine the result of each embalming operation which is performed. Then to go further, it is well-known that some people contain a large proportion of blood fluid with large arteries, veins and capillary or flesh cells, while others of similar size and weight may have only small arteries and but little blood fluid, and yet, in life each person will be in good health. Disease may or may not take away this fluid, though it will likely follow diseases that the blood will undergo certain changes more or less peculiar to that disease and with death these body fluids may leave such changes by its chemical conditions as will cause the body to take on a rapid form of dissolution, or this chemical change of the blood may be such, like great body emaciation, when only the slowest form of dissolution or dry decay will take place.

Death Causes and Prognosis.

All progressive embalmers will see at a glance that what are here given will be of the greatest consequence to them, as they

may then know and understand the important features which disease may cause, and so destroy certain local or general functions of the internal body structure in so many ways, that it then becomes necessary to use the greatest care in order for even the highest skilled embalming surgeon to embalm those bodies which may have undergone the destroying influences of such diseases, and as there are a great many diseases the embalmer ought to know, what disease gives that class of body destruction, from local or general cause, which are of such nature as to interrupt the process of the embalming operation.

Diseases of the Lungs, which may be followed by death, are

- Pneumonia,
- Pleurisy,
- Collapse of the lungs,
- Asthma,
- Consumption,
- Galloping consumption.

Diseases of the organs of circulation :

- Pericarditis,
- Endocarditis,
- Aneurisms,
- Apoplexy.

Diseases affecting the organs of digestion :

- Inflammation of stomach and bowels,
- Peritonitis,
- Complications,
- Malarial, typhus and other fevers.

Diseases of the Liver,

- “ “ Kidneys,
- “ “ Diabetes,
- “ “ Dropsy,
- “ “ Brain,
- “ “ Pregnancy.

Unclassed—

- Tetanus (lockjaw),
- Hydrophobia,
- Hemorrhage,
- Delerium tremens,
- Morbid growths,
- Venerial disorders.

Accidental death—

- Drowned,
- Killed,
- Poisoned,
- Electrocuted.

Epidemic and dangerous diseases :

- | | | |
|-------------------|----------------|-------------|
| Measles, | Scarlet fever, | Diphtheria, |
| Membranous croup, | Glanders, | Small-pox, |
| Influenza, | Yellow fever, | Cholera. |

It is scarcely necessary to argue why one body deceased of one disease is not physically the same as it would be by another disease, for if the student will carefully read the brief outlining history of each of the above diseases, they may become well enough acquainted with each one of the morbid conditions, which, from special reason, become diseases that are most perfectly classed according to the well known pathological history of which they belong, and with this history comes every known complicational malady, and their probable terminations are shown in the most reliable and specific detail of what belongs to that specific disease, and when death destroys the further pathological history. Why should not the embalmer's observation be made methodical and specific enough to at least enable themselves, and others skilled in the art, to provide better classification of the true physical conditions, as it relates to various morbid stages in primary conditions of putrescien; for as physical conditions of life are related to diseases of a given class, so also will the physical condition be confined to that class of animal putrefaction which are dependent upon that class of body substances after death.

Simple Chemistry of the Body Substances.

Ingredients of the flesh—Water and Various Salts— which comprise various elements like hydrogen and oxygen, and the metals of the alkaline and earthy salts, like sulphur, phosphorus, chlorine and in general terms of the ingredients of mineral substances.

The second class of body substances are classed by Dalton are hydro-carbonous substances and this adds carbon with the elements of hydrogen and oxygen and so the substances of this group are shown in starch, sugar and oil.

Starch has the property of changing into sugar, sacchrine matter or the starch transformed into glucose by the addition of water that is slightly acid or a similar chemical composite which may be continued for some hours, transposes the starch into a gelatinous mass which thickens and again is converted into dextrine and finally becomes sacchrine or sugar. It is said that glucose which is the representatives of sacchrine substances occurs more frequently in the animal fluids than any other substance, and what we would have the readers to note is that as this starchy substance of the human body undergoes several changes and that by the removal of life's function a spontaneous change is then to follow by a process of fermentation with all the fluids of the body which contain the sweet substance. While it is true that saccharomyces ferment and germinate during life, in fact, are necessary to the normal functions of life itself.

yet, there comes several forms of specific animalcuation which are each due to a variety of conditions which cause them, after death.

The fats, oils and adipose are the most important substances which resemble each other in general character, though differ mainly in the degree of consistency. Stearine, the first of these general varieties, being the most solid at ordinary temperature: palmitine holds an intermediate position and oline, the last one, is fluid, and this last fatty liquid, desolves both the stearine and palmitine and with the change which death makes, these fatty substances undergo the most rapid chemical transformation. And as we wrote "The Casket" away back in the seventies, this colorless oily substance becomes as an emulsion, of all albuminous ingredients of the blood, and lymphatic substances of the body, by reason of a process of animalculated fermentation due to the ratio of a given quantity and quality of what the fluids of the body may be comprised of. Deceased bodies that possess fluids that are rich in the above substances, we would designate as sacra-albumic, for want of a better word by which to denote them, and it is this class of subjects which are liable to be composed of fine cell and tissue flesh structure, while the emaciated, or more properly speaking the poverty, or watery fluids which disease or other causes may leave in other bodies do not possess, that substances most necessary for the growth of micro-germ processes of decomposition.

In order to explain why individuals may vary from time to time, we would say that Dalton tells us that large, stout people usually follow by hereditary laws, and the emaciated and sallow ones by the same reason, though the same person may vary at different times much in accordance with their mode of life or that of the condition of the health, or disease may predispose an excessive adipose or the preponderance of fat, to that extent of an abnormal physique. While in other persons the most emaciated body condition may follow by reason that there are some persons who scientists say are physically incapable of taking starchy or sacchrine substances and converting them into fat or adipose tissues. While with another under the same diet will convert the same into fat, and possibly that of the most excessive character when obesity is the result.

Bacterial Effect.

As bacterial effects the decomposition of albumenoid matters by means of vegetable activity, putrifaction is

limited by the same conditions. Bacteria, Carpenter tells us, belongs to the group of colorless cryptogamic plants or fungi. Like other fungus of this class, they assimilate organic substances ready formed, at the same time absorbing oxygen and exhaling carbonic acid by their animalculated putrifying infusion.

As oxygen is the true scavenger of the earth, so it is, therefore, the first essential to the growth of the process by which putrification is carried on with, and what is more, is, that as all plant and fungi life is not possible without moisture and the required moderate temperature. Putrification may be suspended more or less indefinitely: yet at the same time nature's law provides a way by which to renew the work by which all organic substances may be reduced back into the primary element to which they belong, and putrification is the first co-operative agent of the scavenger oxygen.

Embalming Prognosis.

Now, to discuss the important question properly, the laws of chemistry teach us that when two opposing bases come together that there is a chemical law which will bring about certain forces of combatibility and when once these two classes loose their coherent force, it is only when one or the other has been exhausted by the power or influence of the stronger one, or if equal in the base forces they may become as neutral. However, it is not purpose to take space necessary to show a detail of these two combatible elements further than to say since, that which now concerns the embalmers the most is to be studied under the class of body flesh and its fluid substances. These are in such substance of the body and found to possess such chemical ingredients as may sooner or later become combatible by the well-known laws which control their elements.

While nature's laws are strange and deeply mysterious, yet much of this mystery has been quite clearly defined by methods of study and observation, and by this way all progress of art and science has been brought up by so much of those laws which, properly speaking, belong to the science of chemistry: and now if the embalmer would advance his professional knowledge as it ought to be done, then this may be accomplished by the same rule of method as by those of any other of the established sciences.

We consider that the most cardinal governing points of embalming for both palative and general treatment will depend more largely upon the specific conditions of the

fluid substances of the body and its corresponding flesh cellular structures, than will those bodies which heretofore have been denominated as large or corpulent, and in order to be fully understood we say that as all stages of animal decomposition are more or less dependant upon primary causes which follow primary conditions, and as putrescions are known to be variously involved by animalculations, each of which become specific under specific causes, therefore, we as thermal and specific observers may see that all practical embalming must be governed more or less by the same laws which produce these various classes and stages of either the sporific dissolution or the slower process of wasting decay.

Substances under the name of alkaline phosphate are important ingredients of the human body. These alkaline salts are readily soluble in water though they exist in both the solid and fluids of the body; while on the other hand certain other substances are classed as having a strict acid reaction. This class of body fluids are the

Gastric juice,	acid,
Perspiration,	“
Mucus of the vagina,	“
Urine.	

The other substances of the human body are the

Blood plasma,	alkaline,
Fluids of muscular tissue,	“
Synovia,	“
Pericardial fluid,	“
Cephalo-rachidian fluid.	“
Lymph,	“
Aqueous humors,	“
Mucous,	“
Milk,	“
Spermatie,	“
Intestinal juice,	“
Bile,	“
Saliva,	“
Pancreatine juice.	“

While it is true that this character of both the acid and the alkaline reaction, are those properly due to the normal condition of life, yet, there are ample evidence which go to show that this acid reaction, and the alkaline reaction, will each follow with more or less influence which by the first chemical action may lead to various other similar influences and so terminate with disastrous consequences, which upon primary causes may be shown as due to some definable ingredients, which if so, may be shown to produce the same ratio of a destroying

influence, and so follow with putrefication and possible spontaneous dissolution within the body which contained what in the normal functions of the body, are the first elements of life but afterwards become the first elements of body destruction.

Body Substances as it Relates to Putrefying Causes.

Albumen of the blood.

“ soluble in water.

“ thickens and sours.

“ forms carbonic acid gas.

“ fungus growth of vegetable cell.

“ “ not soluble in alkali.

“ specific and rapid dissolution.

Geletine substances of the body.

“ thickens: soluble in water.

“ putrifies: ammonial gas.

Blood plasma.

Fibrine swells in weak acid and water.

“ soluble in alkaline solution.

coagulates in alcohol and becomes elastic.

Corpuscles swell in water.

“ thicken and ferment.

“ saponify in alkaline solution.

Lymph and albumen separate.

Oleum softens and grows watery.

“ saponifying alkaline solution.

“ coagulates in alcohol.

“ dissolves and grows gummy.

Flesh decay may be caused by several primary reasons.

Moisture fosters moulds. Parasites.

Acidity “ spores.

Alkaline “ rancidity.

Water various gases.

Alcoholic

Etheric

Producing fungus.

“ fermentations.

“ bacilli.

Producing flesh wasting, ammonial gas.

“ “ softening, carbonic gas.

“ “ thickening, putridity.

Sulphuric acid causes starchy substance matter to swell, it also thickens glucose.

Citrate of mercury acid colors albuminous substances red.

Albumin may be solid or fluid.

The decomposition with caustic, alkali, yeast, car-

bonic acid, and ammonia gas, oxalic acid, sulphurous acid and other products of decomposition.

Albumin dries like gelatin—absorbs water and swells. Slow, continuous heat influences it and suppuration follows with the rapid destruction of every substance around it after death.

Dry albuminoid does not putrefy.

When exposed to moisture the body softens and finally decomposes. No substance is said to be capable of putrefaction without it contains albumin. Fetid gases are due to more or less albumic substances.

Hydrogen Sulphide, Carbide Ingredients.

Carbonic Acid, Nitrogen and Ammonia, Albuminoid, Putrefaction requires, oxygen and moisture. Moderate temperature.

The process of putrefaction in albuminoids is said to be analogous to that which causes alcoholic fermentation, mucuo germs, Bacterium—and like forms the putrefying infusions—spontaneous growth of reproduction.

There are several classes of albumin matter—several ferment multifers.

Stages of body decay—Lactic acidity, carbon gas.

Amonical gas.

Phospho sulphate gas.

Alcoholic yeast causes Fermentation.

Ethereal Spore “ Fungus.

Moisture “ Bacilli.

Putridity, flesh softening, moisture.

“ thickening, water, gas.

“ wasting, water, gas and mucous.

Glucose—its fermenting action is due to that action.

Starch—of fungus. Plant cell life called

Glycogen—saccaromyces.

Fats.

Varieties of fat—slightly soluble in alcohol.

Stearine—freely soluble in ether.

Palmitine—saphonified by alcohol.

Oline—coagulated by acid.

Water and oil.

“ “ albumen.

The embalmer should carefully study the following by making daily observances which the author believes sooner or later will lead them to some new and valuable discovery by which to govern their own practices.

First.—The fullness of the blood vessels.

“ “ lymphatic vessel.

“ “ capillary vessel.

Second.—The fluid state of the blood.

Tendency of the sacchrine, (sugar.)

“ “ albuminous.

Tendency of the gelatine.	
“	“ glucose.
“	“ oil globules, (fatty matter.)
“	“ uraemic.
“	“ white corpusels.
“	“ red corpusels.
“	“ fibrinous.
“	“ poverty, (watery blood.)

Third.—Flesh texture—dry
 “ “ moist.
 “ grain—fine.
 “ “ porous.
 “ cells - soft, oily, tender.
 “ “ rough, dry, expansive.

Fourth.—Rapid dissolution and putridity followed by the cadaveric softening of the flesh tissues dependent upon moisture, air and warmth. The exclusion of all three of these principles will retard the process of dissolution.

Fifth.—Observe that soft, fine grain, moist and oily flesh cells are tender and as these fluid substances are sweet, albuminous and oily they sour and so rapidly does this fermentation take place that the whole capillary system and lymphatic glands become involved in amonicals, fluids and gases, and if we would supply any chemical reagent this must be by prompt and a thorough application of embalming solution, through means of embalming surgical operation and the specific drug which will control the body substances by the true laws of cause and effect, and in order to accomplish this the specific causes of putrition within a given substance must be met by such chemicals as are shown to produce the desired effect that is required to arrest the process of body dissolution.

Sixth.—Note that dry, porous and expansive, course grain flesh tissue, may always be successfully treated by the embalming process, provided only, that the chemical reagents do not antagonize the body fluid and flesh cell substances, and so destroy them instead of embalming them. And what is further, the embalming operation must be completed by the surgical operation to the extent that all remote substances be placed in direct contact with the neutralizing and correcting influence of the embalming solution.

Appearances at Time of Death.

Anaemia,	- - - - -	pale, marble-like.
Congestion of the brain, fever, etc.	- - - - -	flushed.

Hectic fever, (deep, low fever,)	-	-	bright fluid.
Low fever,	-	-	purple or livid.
Jaundice, billious fever, yellow fever,	-	-	yellow.
Collapse, cholera, cyanosis,	-	-	blue.
Chlorosis,	-	-	sallow.
Asphyxia,	-	-	almost black.

Great emaciation generally occurs with all deaths ending chronic diseases, and this is sometimes brought rapidly on by diarrhoea, dysentery, etc., and there is sometimes a most astonishing change which occurs in the adipose tissue, and in the plumpness and roundness which may cause flabbiness and shrunken appearances of the body after death. Especially is this so with children as extreme and rapid changes are more general with the young than those of middle life and it must be said that the color of the skin varies much in diseases as shown above, while the general disturbance of the excretion and other fluids of the body may be determined to quite a measurable degree by the above characterized signs.

With diseases like those caused by an inactive kidney, urenic poisoning causes death by coma and often convulsions precede death and under certain diseased classes, this renal disturbances will leave a large portion of uric fluid in the blood vessels. One class of this disease may cause an acid base, while another disease leaves an alkaline base.

Morbid and Physical Obstructions.

There cannot be any complete embalment made by injecting the arteries and veins when there are obstructions: and as all the organs of the body may become obstructed through either disease or injury, and as every class of disease is shown to cause some specific or local disorder while carrying on its morbid attack, and this so often to that extent that some one or more of the organs of the body may be destroyed, much in accordance to the known morbid character peculiar to each class of disease, and if embalming may be made so complete as to overcome all these disorganized internal body substances, it must be done by the most careful steps of method, and so all these morbid conditions should be studied by that class to which they belong.

Post-Mortem.—When the embalmer is conducting an examination with the view of determining what special embalming operation may be the best, there will always be more or less importance found in each of the great cavities, the **head**, the **chest** and the **abdomen**.

With the first there may be shown almost every defect with the body. Black face, thickened lips, en-

gorged neck and many other ghastly conditions which may intervene and much of this by either single or collective causes coming from various natural causes like that of swollen viscera of the thorax or of the abdomen, or possibly may be caused by the condition of the brain or spine like that of souring body fluids, gases, etc.

The Thorax should be studied with a view of determining whether there be any abscess, ruptured artery or vein, by fluid infiltration or free gases contained in or around the viscera.

The Abdomen should be studied to determine not alone the possibility of abscesses, ruptured arteries or veins, fluid infiltration or free gases in or around the abdominal viscera, but with a view also of determining possible stranguary obstructions; sexes if woman's disorder, like that of ovarian or fœtal disorders.

What to look for, and how to prove cannot be shown in this chapter, but the reader may aid his knowledge greatly by becoming familiar with all the denominate features of death ending results by studying closely and faithfully each chapter of **death by diseases** of the

Organs of respiration,
 " circulation,
 " digestion,

and such other diseases as are given in that department of the book.

Obstructions Which May be Caused by Disease or Injury.

Of the Brain—May be caused by blood clot, mucorinees, liquification.

- " Arteries - Rupture, clots, abscess, adhesion.
- " Viscera—Softening, perforation, infiltration.
- " Stomach and bowels - Rupture, obstruction, perforation.
- " Cavities—Adhesion, perforation, infiltration.
- " Adipose—Liquification.
- " Ovarian—Tumors, innumerable pus or fluid sack and false membranes.
- " Fœtal—False membrane, leakage, perforation, rupture.
- " External—Superficial and deep fasciæ, muscle, adhesion, cædævic softening.

Theoretic.—Signs to be determined by inspection—general expansion. Local bulging of the chest is usually upon one side only, and may be caused by **gases, purulent fluids** or thickening of the flesh tissue of the viscera, from deseases like

Pleuretic effusion, (*See Diseases.*)

Pneumothorax, a condition in which water, air or other gas is present in the cavity of the chest.

Emphysema of the lung, inflammation or a condition produced by gas or air diffused in the cellular tissue.

Aneurism, cancer, etc., or more rarely by

Hydrothorax, accumulation of serous fluid in chest.

Pneumonia.

Incipient tuberculization.

Local depression of the thoracic walls may result from diseases like

Absorption of the pleurilic effusion,

Consumption,

Pleuro pneumonia,

Cancer of the lung.

Abdominal signs to be determined by inspection of various general or local engorgments of the abdominal cavity surface as may be caused by diseases like

Dropsy,

Congestion of the bowels,

Flatulency, (colic,)

Peritonitis, (*See Fig. 28.*)

Gastritis,

Hepatitis, impregnated with sulphurated hydrogen gas—this may be a condition of the liver.

Ovarian tumor,

Enlarged liver or spleen,

Bright's diseases,

Albuinary,

Pregnancy,

False foetal accumulation,

Fluid accumulation,

Ammonical gases,

Carbonic gases.

Modes of Death.

Dr. Hartshorn says death may occur by **Asthenia**, the natural forces of the system being exhausted or destroyed so that the heart ceases to beat—as in lightning stroke, poisoning by prussic acid, etc.

Syncope (fainting) simulates or threatens asthenia.

Death by **Aneamia**: When the blood is rendered insufficient for life—as from hemorrhage, after labor, surgical injuries or the bursting of some artery as in **anurisms**, etc.

Death by **Apnœa**, or asphyxia, is by the arrest of respiration (breathing), either from disease of the lungs, obstruction of the air passages, defficiency or impurity of the air.

Death by **Coma**. The brain and medulla being made incapable of sustaining innervation—as in apoplexy, opium poisoning, etc. Sudden death may occur from

Apoplexy,
Valvular heart disease,
Rupture of heart (syncope) in fatty degeneration,
Bursting of an aneurism, or abscess within the thorax or abdomen.

By suffocation,
Violent mental shock or alarm.

Proofs of Death.

All discreet and conservative embalmers know that it becomes their duty, when by reason of their professional calling, they are required to examine the dead preparatory for embalming, for a due observance of every case in examining the dead, should be made, and this by the most exacting and positive proofs, which show two or more signs of death's undeniable marks. Many prominent persons have been heard to say that they would not like to be embalmed, and that they would not permit any member of their family being embalmed. When asked for the principal reason, they would reply by saying: "What if they were not dead?" In replying to the question, we might ask, what would be the horror, if they or anyone else should be buried alive? as some writers have heretofore tried to show has been done at certain stated intervals. Now, the truth is that all such matter is sought and read as sensational matter, but this is all wrong, since the very idea is falsely cultivated in the minds of some unfortunate believer. Better evidence of the actual truth should be required before the press publish such a wrong. It can be nothing less than a criminal act upon the part of some one, who, either through evil design or carelessness, would make such a blunder as to bury anyone alive. But suppose the subject is not dead? as my friend said. The professional embalmer of today is an honest and intelligent man. His proofs of death are good. But suppose he should be mistaken and begin operations for embalming the body? *The very first cut of the knife would startle the nervous system and so rally the vital forces*; but should this fail, the modern embalmer will take up an artery as nicely as the surgeon, perhaps, and on opening the artery the blood would spurt should there be a spark of life within that body. In such a case the embalmer would tie the artery and call for the doctor. It may be seen that all those who may fear the horrors of being buried alive, may rest assured that the greatest security against it would be to employ some honorable and cultivated embalmer. These men know that they would make a great name by timely saving some one at the last opportunity.

Death Proofs.—A complete cessation of the functions of the lungs and the complete cessation of the heart together cannot be resuscitated at any time after one hour's duration.

When these two signs are known to have existed for even a few minutes, there can be no mistake in the proof of death. In order to further prove that there is no life, a looking glass placed over and near the mouth and nose would show specks of moisture in a few seconds afterwards, provided, there was any feeble breath existing to give life with. Dead people do not breathe, and live people do not stop breathing except in certain brief spells of catalepsy which is marked by unconsciousness and fixed rigidity of all or many of the voluntary muscles.

and maladies peculiar to that of asthenic disorders, epileptic, or poverty of the blood making functions of the body. While convulsions are usually caused by fever or some over nervous excitement which may end in death after many hours of unconsciousness. Yet, death proofs are not to be mistaken when both the heart and lungs cease the life continuing operations.

There are six principal proofs of death:

1st.—Cessation of breathing.

2nd.—Cessation of heart action.

3rd.—The eyes are set in a glassy stare.

4th.—All the joints and muscle become fixed.

5th.—The flesh surface is cold and clammy.

6th.—The body heat passes steadily away.

Observe that

A livid face is not a proof of death.

Lingering warmth is no proof that the body is alive.

The deathly aspect of the face may or may not be a proof of actual death.

D.—Taking up any artery would shock a living person, and if not, the arterial blood would spirt no matter how feeble the heart's action might be.

E.—The feeblest breath would set a light feather into action when placed at the nose.

F.—The skin would be flexible and pliant.

G.—The finger joints and wrists would be flexible if the person was alive—excepting spasms.

Doubtful Theory.—All voluntary or involuntary cessation of life functions are said to be possible, but the author has as yet found no proof of it further than that produced by some fit or convulsion having only a few hours duration at most, and it is only persons of the greatest ignorance who could or would have pronounced such persons as being dead, while undergoing such prostrating attacks.

The Relations of Morbid Pathology to the Science of Embalming.

While Renonard, Sullivan, and other writers upon the subject of embalming have laid down several good general rules for governing the inspection of the dead, yet the author has not seen any suggestion which would follow the inspection as deeply into the question for denominating classes and descriptions of the various stages of putrescion, as now required for their proper guidance and advancement.

As rational medicine is shown to have become specifically denominated by its class, and this for diseases of specific classes,

so also will follow by the same rule of intellectual reasoning, at least the author believes that embalming drug reagents must be classed for uses that correspond with the given stages of body dissolution.

If embalming is a progressive science, then there must be a prognosis, which will follow with each physical sign, and each of these signs must be so clearly described that each one will denominate a fixed principle belonging to that class by the one or more indications which each one may show, as caused by the bodily condition that governs the various stages and processes of decay that follow the line of each class.

By intellectual reasoning we mean that by a close inspection of each body some one will discover a new sign and several observers will each contribute something, and finally there will follow new observances of certain class signs, and these will be so cleverly described as to denominate the primary indications of some true sign, as it may point out some special class or specie of animalculated or non-animalculated flesh or fluid substances more or less peculiar to a governable or non-governable process of body dissolution.

In the past we have been observant of the many physical signs, but we must couple the physical signs with so many indicating signs, and then the embalmer's diagnosis may become a better guide to direct them by new methods for general or special treatment.

When our knowledge of disease will enable us to know the true state, or the varied stages of the internal disarrangement consequent upon known morbid causes, then there will be shown many external physical signs, though each of these may be dependent upon two or more proofs. Yet we may soon be able to class every single observation in such a way as to enable ourselves and others of the profession to supply more practical remedies in every case.

As various symptoms are known to denote certain specific diseases peculiar to each variety of symptoms, so also may be shown that various indications may yet show us how various death marks may, and no doubt will be so specifically described that sooner or later our profession will be able to govern all embalming proceedings by true methods and better modes of treating each one upon the more practical ways, and by that fundamental law principle requires according to its class—as may then be seen by two or more signs that indicate and shows certain fixed stage conditions that always follow by stated progress into results of a known fixed termination.

When a careful examination of the body and its surroundings will not reveal some death mark as sign to show what was the actual causes of death, then by all means, ask someone who knows something of the history of the case, and possibly a word of knowledge concerning the case for the last day or so may enable us to comprehend the true condition, or may do so

when coupled with what may be seen by the physical signs.

Great emaciation and dry cold flesh may soften and putrify, but after the gases are dispersed, or proper vents have been provided, simple reagents may then embalm some of these bodies, but this is not always the case. Why? Because of some one or more kinds of micro-organism which may take place under such class or conditions that there must be both special chemicals and special operations in order to destroy the specific action of such putrefying agents.

Emaciated bodies when soft and damp are already in a state of putrifaction, especially so if the body heat has all passed off. Baccilli.

After death by disease like *cholera morbus* there may or may not be any bodily emaciation, while gastric and biliary secretions may remain within the body.

Cholera Malignant - Copious water fluid (rice water).

Bilious Fever—Altered mucus bile, (fetid) etc.

Yellow Fever—Black vomit, etc.

Ulcer of Stomach—Mucus, lymph and blood.

Cancer of Stomach—Mucus, lymph and blood.

Disease of the Brain—General.

Bright's Disease—General.

Strangulated Hernia—Fetid gas.

Gangrene of the Lungs—Putrid.

Phthisis—Muco purulent blood.

DEATH BY

1. **Asthenia**—Exhaustion or loss of the vital forces.

Syncope—Fainting.

2. **Anæmia**—Privation of the blood.

Characterized by every sign of debility.

Also diminished quantity of fluid in the capillary vessels.

Emaciated condition.

Scarcity of red corpuscles of the blood.

2. **Apnœa**— Absence of respiration.

Asphyxia—Suffocation, want of air.

Nonconversion of the venous blood of the lungs into arterial blood.

Stagnation of the blood taken place in the pulmonary capillaries.

For want of oxygen, as in gas poison, or in drowning, hanging, etc.

4. **Coma**— A deep sleep; sleep of death.

Brain forces lost.

Apoplexy—Some internal hemorrhage.

Sudden death may not follow.

The jugular veins are usually extended during syncope (fainting spell).

There are four distinct classes of apoplexy.

See Diseases.

The Chemistry of Anti-Septic and Embalming Remedies.

There are numerous compounds upon the market as combined anti-septic and embalming remedies, some of which are worthy of no small consideration, but the author has not been commissioned to specially deal with either of them as all of them are proprietary remedies and vary in the standard of quality much in accordance with the personality of those engaged in selling them.

Speaking of "Free Chemicals," and we may say that all remedies which may be used to destroy microbes or mœlific germs and to prevent or arrest septic process as anti-septic or germicides may or may not combine into a useful embalming fluid.

Many of the very best anti septics now known to that science cannot be used to make such a fluid compound as the public now requires. A sample of such drugs and chemicals may be shown in the statement of a very few of them. Permanganate of potash, sulphur, chlorine gasses or the other compounds like the bromides and chlorides; then comes iodiform, eucalyptus and a great many others which are known as possessing some specific property that gives them some quality as an anti-septic, yet, for various reasons they cannot be made as practical remedies either singly or by any known combination of them for the embalmers use, because of first, their combating tendencies when combined with other body substances, or if useful in one case, they will destroy another subject entirely.

The sciences tell us that those remedies are entitled anti-septic which are employed to arrest fermentation process, and this same science shows of the generally admitted facts that every kind of fermentation is co-relative of the growth and multiplication of a living organism, and further, we are told that it is by various ways that the morbid process is fostered and so become various distinct species classes of microzymes, and that all bacteria either stands in a consecutive relation to the morbid process, or are necessary to its evolution and development in forming all kinds and classes of putridity and decay, and especially is this true with all that class of substance like that of saccharine and albuminous matter, as this, and similar classes enter into the composition of animal flesh and are co-relative substances that foster various kinds of micro-germs that will multiply more or less rapidly and so destroy the body before this danger can be diverted by a chemical agent to destroy them.

In order for the embalmer to fully understand the commanding importance of this subject, it would be necessary to take up the known science as this is detailed by several authors like Virchow on the subject of "**Morbid Pathology.**" This would give the embalmer a first step to a knowledge of that subject which today becomes an important question and one by which to govern its future science in methods for treating putrescence, for if there are shown to be various stages of disease which are dependent upon a class or a specie of pathological organism which in their severalty result in death, and now as the embalmer's special science of

methods must commence here; when all this art must be rested upon something; then what is it to be? Only one process for this multitude of disease resultances? If it is to be this and nothing more, all science and all discretion would say that the only single and safe process would be to burn all these unfortunate victims of disease and death, and this for the benefit of the public health as a sensible measure of sanitary science, because it is true that no single process, or single drug, or compound has been made to do the work of correcting all the resultant stages as seen in various poisonous conditions as they come from the various stages of putrifying deceased bodies which we are required to embalm.

Now, in as much as it is true that a special surgical embalming operation may give greater completeness to the embalment of any case, so, in the same ratio ought we to begin the true study for drugs and remedies which scientific observation shows as possessing specific properties which qualify them in special instances of special disease classes.

As the laws which nature sets forth by specific causes has become known to control and direct a given course by reason of morbid tendencies, why not so with the governing principle of such physical dissolution as well? While the morbid process of a given kind ended in death, why not so by this same process or its relative consequence? and yet, by this means be so far traced as to show the more important features which may or may not become evolved in one or more distinct classes of dissolution. As we know that all dissolution are not alike, then why? is it because of the various physical condition, or is it because of the primary morbid condition, which, though the relative process of disease consequences, end in one form or by various forms. As there are but one specific class which is peculiar to a given disease, yet, after death there may be several varieties of dissolution and putrescing forms. Then why is this so? Is this because of some disease complications, or is all dependent upon the physical conditions of the subject to be embalmed, or to go further, is it because of the atmospheric surroundings? These are hard questions, yet some one must answer them, and these questions are each open and demanding that some one shall answer them by some fixed definition of each one, and this only by methods that can stand upon something more than theory. As the embalming science of today requires a long line of simple, yet specifically demonstrated facts in order to give true methods for embalming all classes and conditions of deceased bodies as they should be.

Now, in what form putrefaction commences within a given body and under a given condition of disease, each with their various forms of septical poison, is yet to deeply involved in theory both for the embalmer's uses as well as for the physician's sciences; and while the highest scholars are experimenting in these special sciences as they are also called for by the requirements of medicine. The modern embalmer should strive for that class of

these special sciences and remedies which are now required for the advancement of this profession.

While it is true that the embalming profession has many valuable methods and processes for embalming the dead, the demands of true progress require that we should go into the highest plains of knowledge, and as we study for something higher, we should not lose sight of the things which are now before us, for it is not from what we expect that we may boast, but it should be by the true methodical applications of what we already have, if we would become practical and successful embalmers.

While anti-septic chemistry is closely allied to that of embalming chemistry, yet we are compelled because of so many other intricacies to study the question of embalment if we would determine upon better methods to govern our practice when engaged in that work, while we leave sanitation to the direction of the physicians.

With a thorough knowledge of diseases as they are related to the physical derangement, we find that methods of instrumentation becomes of the greatest importance, and the question of embalming chemistry involves the whole matter and one which all future results must rest.

Uncertain Actions of Chemicals upon Putrefying Animalculations.

By special sanitary science we are shown certain classes of remedies that not only prevent putridity or poisonous septic conditions, but these may also counteract many classes of septic poison, not only within the body embalmed but also to a limited extent with the atmosphere of a given space, yet, this is not all that is true as may be shown at a recent meeting of the Amsterdam Royal Academy of Sciences, M. Foster treated of the influence of our common salt on the life of pathogenic bacteria and stated from many and varied experiences, he had come to the conviction that, "whereas, cholera baccilli are very sensible to that salt, and when brought into contact with it, very soon die, but the typhoid and pyrogenic bacteria and baccilli of tuberculosis and cattle distemper may remain for months buried in common salt without losing their power of growth and reproduction." The salting of butcher's meat may, therefore, in some cases prove ineffectual. M. Foster went further and exhibited some preparations obtained in the hygienic laboratory which went to prove that neither the baccilli of tuberculosis nor cholera baccilli can develop under the influences of iodoform vapor. He says further that, "it may be shown that a remedy which in diseases may possess great antiseptic power, yet they may have no quality worthy of note

when brought to bear upon substances though of a similar life as found in decaying flesh matter."

With the results of experiments made in Berlin by Prof. Uffelmann show that cholera baccilli remained alive in water from one to six days; in butter, six days; in cabbage, three days; on a postal card, twenty-four hours after drying, while on silver or copper they die in half an hour. It is also shown that no living germ can resist the antiseptic power of essence of cinnamon for more than a few hours, is the conclusion of M. Chamberland as the result of prolonged research and experiment in M. Pasteur's laboratory, and this is said to destroy microbes as effectually if not as rapidly as corrosive sublimate.

Now, again we have shown a remedy of known and positive power of germicides when administered in a given form, as all such experiments are based upon nothing but true laws. But, when we look upon some of the remedies, such as has been offered through certain professed aspirants to our profession, what testimony of authority has ever been given or shown farther than that of some egotistical and aspiring person who have more regards for notoriety than they have for professional truthfulness. Now, as professional people, what can we expect in the way of true advancement of the sciences so long as we give countenance and patronage to such misleading representations? Is it not time to look about us for the true principles of working results, not only in a better classification of diseases and their individualized consequences? Then again, let us look into the compound which are made with innumerable combinations of drugs thrown together without any regard to their combative tendencies, and so one property may be absorbed into an opposing element to destroy rather than embalm the body as we are told it will do. As both Pasteur and Foster tell us that a remedy which works an antiseptic result upon diseased bodies in life, may become the most active agents in a destruction of that body when deprived of its vitality to counteract it. And our own experiences show this being reasonably true, what possible good results can be expected from any single or compounded remedy that spring up without a show of possessing any active principal, or possessing any property for equivocal results? All intelligent embalmers should know there can certainly be no good to come from a drug solution which by its nature becomes a combatting element to the cells which go to make up flesh tissue, because, in this a destroying influence is brought to bear by new chemical changes, and so the tendency is to break down or soften the tissue, and thus the most putrescent forms of decay are incited. While this may be slow in some, in others it may be stimulated by these seemingly harmless drugs to that extent that almost spontaneous destruction is shown, when we are resting quietly upon our belief that as we embalmed one body and had no trouble after using that embalming solution, the one case in hand will keep since it has the same fluid treatment, and so it now becomes

clearly shown that the embalmer should be able to see by some physical sign what was likely to follow each case.

Perhaps it would do to tell some people that one kind of pill would cure all manner of diseases, yet this would not be believed by men who are intelligent enough to become good, practical embalmers.

While there are many known drugs and chemical combinations or compounds which are to be acknowledged as embalming remedies, yet each one of these must be classed as possessing specific qualities for specific purposes, if we would acknowledge the truth of all nature's laws, as disease results from a specific cause. There are found certain remedies which are shown to possess the property of or specific elements which may, under certain conditions, be made to repel the attacks of that disease, because of certain fixed principles of nature's law which commingle the chemical elements with the abnormal forces of the disease, and this to that extent that the vital forces may be restored to the normal condition of life through the careful and theoretical management of the doctors

So many classes of diseases are today resting in the most explicit forms, and side by side of these comes innumerable remedies which are shown to be of the most practical utility, and this not alone in medicine but specific laws of chemistry moulds the way to all other science and as the modern demands require modern science in the world of embalming. This science requires new philosophical experiments in order to elucidate new light of these truths of embalming chemistry in order to meet these new demands which are being of this art and as Prof. Rudolph Virchow, of Berlin took up the unfinished work of Hunter, Loebig and others in completing the work of morbid pathology, so may some physiological writer take and complete the science of "**Pu-trescations**," and show us new and better methods of embalming chemistry.

Theory of Progressive Embalming Necropsy.

See Physical Hindrance.

Science shows us how that a rapid and quite uncontrollable dissolution will take place in deceased bodies which appear similar to another body that has been kept nicely and without causing any trouble whatever—and while these have caused such a deep mystery in the past to so many embalmers throughout the country, it ought not to be so with those who will now take the trouble to learn of the governing reasons which are the primary causes of various forms of rapid dissolution since there are known to be several classes of them.

The embalmer should know that there are many primary facts

which, as natural surroundings, that become the governing principle of each case, and in order for them to be able to understand the various situations they should know what analytical science show as the first law principle of both animal and vegetable decay.

When we duly consider the various substances of which flesh and blood are comprised, we may be able to comprehend the elements of both the physical structure and conditions, as well as to know the evolution, which by nature's law must bring about, sooner or later, yet dependent in the main upon and by that force of structural conditions which become co-relative to the primary cause.

It is true that it has only been recently that the scientist discovered means by which to fully determine and class the many kinds of sporific or bacterial causes of dissolution; and now that we know the fluid constituents of the human body, and that the flesh tissues are cells composed of gelatin, sacarine and albuminous substances that are fastened into fatty oil substances, and the blood lymph and flesh juices of the body correspond with various proportions of these substances and a large per cent. of water, we may then be able to see why one deceased body will not keep just as well as one that may appear to be similar in all outward appearances, for now we should know that these bodies are not alike, though heretofore they have been supposed to be alike; in other words, we have supposed that flesh was flesh and that blood was blood, but now we must consider that there are many causes and reasons which make both to vary, and so become correspondingly dependent upon natural laws of physical structure, and by this we have various flesh and blood compositions.

By this we are to understand that all forms of flesh dissolution are now to be considered by a new theory, which should be set forth as the embalmers' methods by which to denominate several classes of flesh putrescations or decay. If what we have said be fairly shown as true, why shouldn't there be some true methods devised by which to class the various physical conditions of the dead, and one that would correspond more definitely to the predisposing conditions of each case.

As diseases are different, and are also more or less dependent upon the physical condition of the patient, so will be the different processes of decay, and this in a far greater measure than has heretofore been believed by both the physician and the modern embalmer.

We ventured this theory some eighteen years ago, and fully believe that the time is not far distant when it shall be amply sustained, and this to that extent where all inspective diagnosis will be by observing the death causes first, and flesh structure next and from this base all treatment of both chemical and operative, and become more or less specific in the sense of indicated remedies.

In reviewing this subject cannot we see and know how it is

that the flesh of a robust child is not like the firmer substance of flesh tissue of an adult. The first has a soft, round and full flesh cell texture as it is growing and full of vitalizing flesh fluids, and are under nature's process of building up flesh cells, which the chemist says are loaded with sugar and oils, as spoken of above. While the ways of life with the adult has matured and so has materially changed these functions for more vitalizing substances of strength, and by this dropping the sacarine and albuminous substances in part; but to go further, children do not all grow alike and adults do not all live alike, yet the physician tells us that in either case the normal condition may be considered and healthy. And now to show a point we may see two classes of flesh structure in the children and two or more kinds of flesh tissue in the adult. Death by accident in either of these individuals will result in pulselescing condition dependent and co-relative with the normal flesh and fluid substances of each body.

Death by disease will result in process of decay co-relative with the abnormal flesh and fluid substances that remain in various stages of interruption and therefore may be set at wide variance and deficiency, both in quantity and quality of flesh and fluids of the body from the enlarged down to the dry bones, and we are also told by scientists that the most common process of decomposition in all substances like the normal fluids of the human body are known to be composed of, will result in the formation of lactic acid, and with the acid formation is developed the same species of bacteria that causes it, but as these cease to grow we find their places are supplied in turn by other spores, until several other species of bacteria are produced, each having different characteristics. As we said above, all this multitude were seemingly dependent upon the lactic acid for the beginning; and so with the result which follows by various diseases. We may trace each by its species, from the harmless ones to those species which become the most dangerous poisons, for it has become a generally accepted fact that all contagious or infectious diseases are due to a specific cause which belongs to some specific species of microscopic vegetable life.

The scientific classes to which these little objects belong is the fungi, the special name being bacteria, or in common parlance, "germs."

It is not possible to here go into any lengthy description of the many varieties of these germs, since Pasteur, Huxley, Liebey, and others have long ago done this in the highest sense of this special science. But we desire to say to embalmers that whatever the body fluid substances may be composed of at the time of death, these substances, by reason of natural laws, will take on such revolving changes as are peculiarly governed by each. When the flesh juices and cells abound in sacarine and albuminous substances, lactic acid will soon result after the function of life has ceased, and can no longer maintain the normal condition, nature sets to work to remove it, but what the reader

wants to know is what chemical will stay this work of nature. And we answer that salicylic acid will stop the lactic acid fermentation, and so will boracic acid and alcohol. When once we may be able to supply remedies for such substances, or if we seal the body thoroughly away from the air before certain other germs set to work, the body fluids will not sour. Thus we see by this that the air plays no small part in flesh dissolution. And now as the flesh structure, the fine-grained soft tissue, or the coarse and porous or fibrous texture of flesh, each present differing qualities, and while the last one may be embalmed in a very satisfactory way by those skilled in the art, yet there must be a very thorough special treatment in order to embalm and keep the remains of the first, and so it will be found by so many varieties and classes of diseases, because of the various physical conditions which supply the primary cause for an endless variety which are shown to multiply in classes of germs, or bacteria, and so destroy every vestige of the body. The reader should study Fig. 25, as this shows the deep flesh glands of the lymphatic system, while Fig. 30 will show or explain the veins and mesenteric system, and so by carefully studying the normal components of the human body all can more fully understand the work before they undertake to apply chemical reagents by the various methods that may be shown as necessary, under various circumstances, which disease or other physical condition may indicate, and it is these which all should study to render the most complete by the most simple ways which can be devised to accomplish a good and complete embalment, and so the most intricate work will be made practical by the simplest methods of working processes. Then to make embalming progressive, *see page 10.*

We must turn our attention to the special study of practical methods of surgery, and so learn ways and means by which to remove or get at this fluid and flesh juices, which we know to be the destructive element of the body, in order that we may embalm and keep it such time and purposes required of us as embalmers.

When we look face to face with what are solid facts, do we not see that about all art of embalment hangs largely upon the mechanical measures with which we must proceed? So embalming surgery is now shown to be the first factor, and after this comes the science of chemistry which we cannot discuss farther than by a simple theory which govern the embalming results.

Now, if we have a lactic acid as the primary cause of fermentation in a given watery solution of flesh juices of the body, we must create two or more ways by which this acidity may be neutralized by chemicals.

One of the well-known formulas is found in alkali. When this and a given quantity of acid come in contact, each through a chemical action, will be made neutral. Then to go further, this new substance, by other chemical properties being placed in contact, will cause the watery part to disappear through harmless vapors by various processes of evaporation. While the flesh

substances become greater and finally take on a saponified state, or they may become as the ashes of wood, and so obliterated by time.

The embalming scientists of today are at a loss to account for the various modes of dissolution which bodies present from day to day, for while we have given one general description, and this perhaps the most common one, yet there are still other modes of primary causes of dissolution which must yet be more fully studied, but our purpose in this book is to define simple ways and means of the art, and now what becomes the question of the greatest moment is, "How shall we get at these lactic fluids which are held back in the cells and glands of the lymphatic system?" We know the component parts and we know many chemical reagents which will destroy the various formations of fermentus dissolution, but how shall we be able to reach these cells and minute channels of the body without mutilating the remains of the dead. The Egyptians placed the body in vats of brine after opening the thoracic and abdomen cavities and removing the viscera with hooks. They also removed the brain, and by this means were able to thoroughly saturate all the body substances.

As the modern embalmer can do nothing of this kind, we must turn our study of the art upon other plans for reaching all substances of the body with the embalming compound.

That methods of surgery must be used is now a settled question, and in order to perform the best operation, and such as may be both expedient and justifiable, are questions that are now open for discussion in order to accomplish better and more perfect anastomotic results.

Surgical and Instrumental Embalming Operations.

"Minor Embalming Surgery."

By Embalming Surgery we do not mean any desecration of the dead, and we will say that any careless exposure of the body or needless exploration of the knife or trocar would be considered such by all careful and conservative operators. Skill does no bungling work, and the time has come when all careless and indifferent persons ought to be required to drop out of this work, which modern science makes the work of thoughtful and intelligent men.

Preparatory Arrangement.

In all cases it becomes necessary to place the body in such a manner as to let the air carry away the heat of

the body. Next elevate the head and plan to get all around the body if possible. Good light must be had in order to determine whether the subject is one of a delicate composition of flesh tissue. Next try to determine and locate the quantity and quality of the body fluids, and other physical conditions: Whether the body is emaciated or not, determine the actual cause of any general and local engorgement so as to know whether it is caused by gases or by some liquid infiltration.

The embalmer should always know what disease the attending physician believes to be the probable cause of death, as such knowledge would greatly assist them to determine the possibility of ruptures, abscesses, or blood clots, and such other diseased affections that may occur, and so require some special local or general embalming treatment. *See history of diseases.*

Operative Procedure.

After determining upon the artery which we desire to use, it will be found that the operation involves several consequentive steps, though not of so vital importance with us as when the surgeon undertakes to relieve their patient in order to save life by the skillful management of all such surgical operations; but yet we must practice with all due precision which the art demands of us, and when the first incision is about to be made the skin should be rendered tense by the thumb and finger of the left hand applied to either side of the artery, and the incision should be made directly over and generally parallel through the skin, if the artery is superficial, but if deep cut through the cellular tissue, the length to be according to the fleshiness of the subject. Certain other operations will sometimes require a triangular or round flap. Any one or more of the following surgical operations may become necessary and expedient in order to prepare the body for future exhibition and burial.

The fact that there may be so many instances where both brachial and femoral arteries may be in such con-

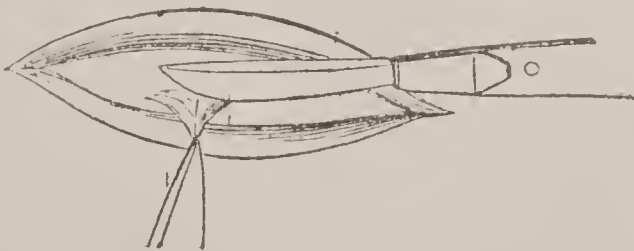


Fig. 1—Primary Incision.

dition as to render them unfit to make the usual incision and operation upon, and some of these instances may be caused by reason of some suppurative ulcerations, or be found in a badly mangled condition and thus render it necessary for an operation to be performed at some other part of the body, while in other cases some special organ of the body may require special attention when a knowledge of relative arteries and veins will be everything to the operator for both hasty or complete embalment. The larger arteries have firm sheaths, which require to be opened by dissection, while the smaller ones have but slight fibrous investments.

The fasciæ may be pinched up with the forceps, (*See Fig. 1*) when the artery may be raised and slit open and the artery tube may then be inserted and securely tied in place.

The veins are situated on the inside and lie close to the artery, and frequently in the same sheath. Especially is this true with all the deep or trunk veins. The larger veins may be injected, but as they contain so many valves and the vessel walls collapse so easily, these vessels cannot be pumped out unless a silk catheter be introduced first, or a soft wire may be introduced into them some distance and so break down the valves of the veins, provided a round ball be fastened to the upper end, when some of the serious and watery fluid may be drawn out.

Minor Operations Upon the Upper Extremities.

The embalmer's experience will show that many young ladies, and others revolt at the idea of body exposure after they are dead, and it is no uncommon thing for them to leave as their dying request that they shall not

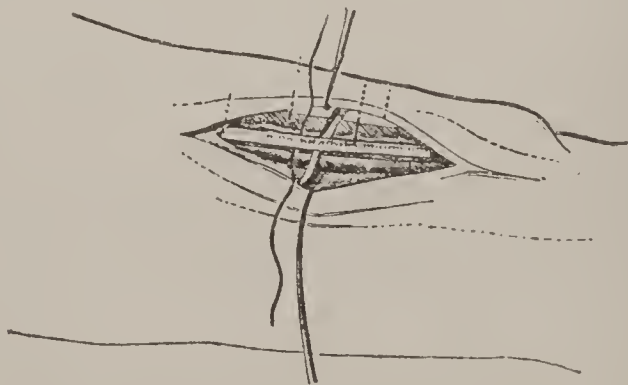


Fig. 2.—Radial Artery.

be embalmed, and while there may be some superstitious belief that excited a dislike to the embalming operation, all that would die away when once the people knew the truth that, first, the embalmer's first operation would discover and save them in case they were not dead, and next, that there should not be any improper body exposure.

Radial Artery and Vein.

Fig. 2 shows an operation at the wrist upon the Radial Artery. As this artery is superficial, it may be easily found on a line behind the thumb. The incision should be made short and varied only to suit the amount of flesh to be cut through, so that the artery may be raised and the artery tube inserted and securely tied in place—while injecting the blood vessels with the embalming fluid, use care to watch the face and see that the solution does not cause the inky blood of the thorax to be displaced by the operation. If so, try to disperse the gases from adjacent cavity of the body with the trocar or aspirating needle and then inject the fluid slowly. See page 81-82.

In completing this operation upon the wrist stitch the wound and bandage it carefully. A long sleeve dress or glove will finish the work quite satisfactorily for all ordinary purposes. An embalming solution should always be used by the ladies who wash and dress the remains of deceased ladies and children, and no gentleman or professional embalmer should perform his embalming operation upon them without the assistance or presence of some lady as this is only a courtesy which is due to them as a proper respect for the dead.

Location.—The radial artery is situated superficially in the lower third, or near the wrist, lying between the tendons of the supinator longus and the flexor carpi rad-



Fig. 3.—Lower third of the ulnar artery.

dials, and it is accompanied by the vein comites and the radial nerves over the radius bone of the forearm. As various injuries like boils, abscesses or similar affections may render the radial artery unfit for operating upon as shown in Fig. 2, so that it may be found necessary to use some one or more of the following operations:

Ulnar Artery and Vein.

The ulnar artery lies on the forearm just opposite to the radial artery and Fig. 3 shows the ulnar artery which is the largest terminal of the brachial artery; as it passes the wrist to the hand it is accompanied by two veins.

Operation.—The ulnar artery may be operated upon as shown by Fig. 3 in the lower third of the fore arm. When it is covered by the superficial and deep fasciæ having upon its inner side the flexor carpi ulnaris muscle and ulnar nerves and upon its external side the flexor sublimis digitorum muscle and under it the ulnar bone. The operation should be made by an incision along the internal border of the tendon of the flexor carpi ulnaris muscle cutting through the subcutaneous cellular tissue and the deep fascia when the muscle may be pushed down sufficiently to expose the artery which lies just behind and under it, accompanied by two veins.

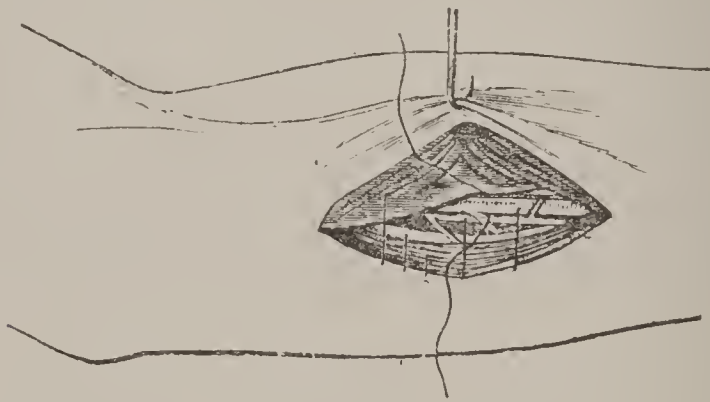


Fig. 4.—The upper third of the ulnar artery.

The ulnar artery may also be operated upon in the middle of the arm as shown by Fig. 4, and the operation will be similar to the above.

Location.—The ulnar artery arises from brachial and curves deeply inward and below the flexor muscles. As it passes along the ulnar side of the fore arm between and covered by both the flexor carpi ulnaris and flexor sublimis digitorum muscles, it is accompanied by two veins.

Operation.—The arm should be held to the radial side and an incision made something like three inches long on the inside of the forearm. After the skin and superficial fascia has been divided this will expose the aponeurotic connection of the flexor carpi ulnaris and flexor sublimis, which is of a yellowish white color. This should be divided with the finger or director from below: press the flexor carpi ulnaris muscle inward and expose the artery which lies under the deep muscular substance and is accompanied by two veins.

A very simple and complete embalming operation may be made upon either hand, and while there may be some objection to this operation, yet, there are many young people who would prefer this operation to that of any body exposure. However, all practical persons will expect the embalming operation to be performed much in accordance to what may be required and the truth is, that all ratio of successful embalming will be only by that of the applied science under the various conditions which require them.

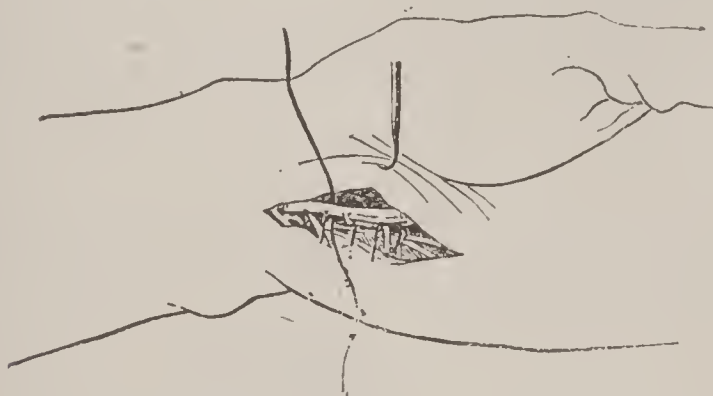


Fig. 5.—Palmic arch of the ulnar artery.

Fig. 5 shows an operation which may be made upon the palmic arch. When the ulnar may be raised in the palm of the hand by using care we may find the vein and afterward conceal the wound with a glove. However, there should be great care used to finish the work by tying both vessels and stitching the wound nicely and securely.

Palmic Operation.

The ulnar artery terminates at the wrist, and is there known as the superficial palmar arch. The hand being held back, make a slightly curved incision on the radial side of the piriform bone: through the skin and adipose

tissue of the hypothenar eminence about three inches in length, the concavity looking inward, when the artery and vein will be found deeply seated in a groove and the incision should be continued along the bone until the

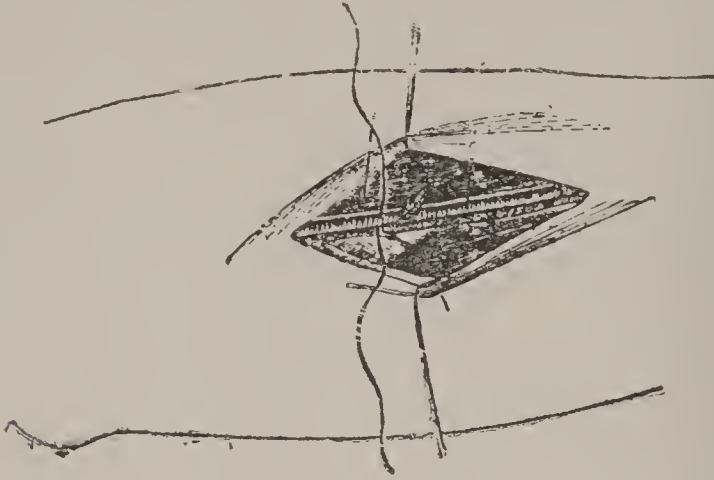


Fig. 6.

artery is exposed enough to admit its being raised and operated upon.

The next operation will be shown is that for raising the radial artery in the upper third of the arm, in a similar way to that shown in Fig. 4 for raising the ulnar artery.

Radial Artery.

Fig. 6 shows an operation for the radial artery and vein, which may be made at the middle of the forearm, and a simple way to locate this artery can be made by tracing the pulse artery, thumb side, from the wrist

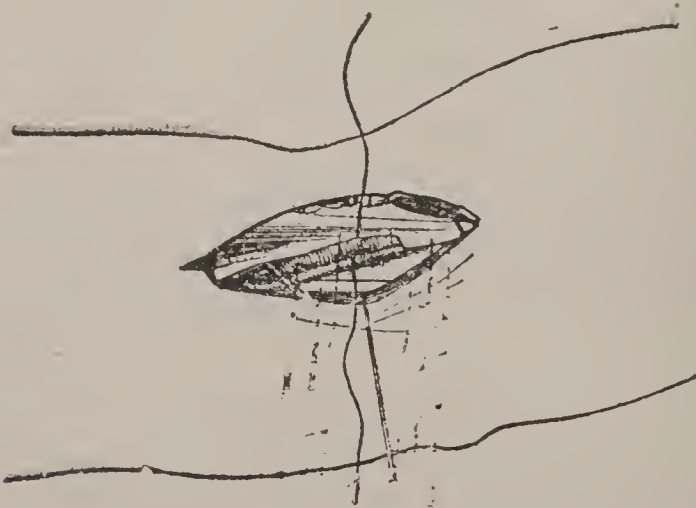


Fig. 7.—Brachial Artery in the Middle of the Arm.

back to a suitable point where an incision two or three inches long can be made so as to divide the muscles by cutting through the deep fasciæ and opening the artery sheath.

Operation in the upper third of the arm for the radial artery, which lies between the supinator longus and the pronator radii teres, the veinæ comites lie immediately on its inside. An incision should be made on the internal border of the supinator longus if the arm is not too fleshy to permit our recognizing its border by the finger depression, and if so, use a line from the middle of the bend of the elbow to the inner side of the styloid process of the radius dividing the skin and the superficial fasciæ: the deep fasciæ is then divided by the finger or by the director while the arm is slightly flexed, in order to relax the muscles, and the supinator longus may then be drawn aside when the sheath of the artery is exposed, and may then be raised and operated upon. The vein lies in the sheath with the artery, and it should be known that this operation is but a few inches below the Brachial artery, and, by cutting upward along the Radial artery until the branch of the Ulnar artery is found, the Brachial artery and its accompanying vein may be raised and injected. *See the following operation:*

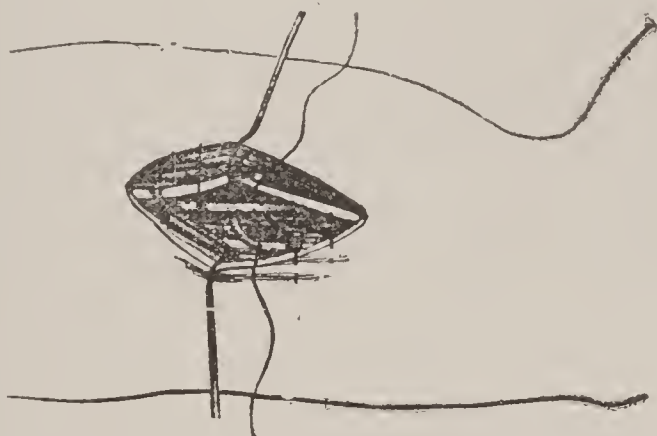


Fig. 8.—The bracheal artery of the right arm.

Fig. 7 shows an operation at the elbow for the Brachial artery, where it lies in the middle of the arm. The median basilic vein lying just beneath the skin. While the artery will be found under the deep fasciæ by the side of the tendon of the biceps, accompanied by two veins. This operation, like a few other similar operations, will only be required when accidental or other causes stand in the way of using what is the well known Brachial artery and vein operation, as described and shown.

Embalming operation in the middle of the arm upon the Brachial artery descends on the inner side, first of the coraco-brachialis and afterwards of the bicep muscles; it is covered by the fascia and integuments and overlapped slightly by the bicep muscles. The artery sheath contains the two veinæ comites. The internal cutaneous nerve lies superficial to it, while the median nerve and ulnar nerve are also near this artery.

Fig. 8 shows the brachial artery and vein and as this is the operation which is most commonly used, it will be necessary to say but little in regard to finding the artery in both children and adults. Though it has not been many years ago when many an undertaker dwelt upon his exploits as a skilled embalmer when the only mode was by this simple but useful operation.

The arm is extended and carried at right angles to the body and held supine when the course of the artery may be recognized by the internal margin of the biceps and coraco brachialis muscles, as the artery and vein both lie together near the bone.

The radial artery may be easily found by the internal margin of the two muscles as the artery lies near the bone under the bicep muscle. When both the artery and vein may be operated upon, though the artery will vary in size much in accordance to the physical condition of the subject, but this is not always the case for with persons of inactive habits the artery may become very small, in fact, remarkably so, when they may be only the opening of a knitting needle size. I have found one case where the brachial artery of both arms was so small as to unfit these vessels for being used because of the shrunken condition of the arteries for want of blood fluid enough to sustain a nominally vigorous life; yet, it is also true that when the arteries may be small, there may still be plenty of blood and other fluids within the body which will be provided with very numerous arteries and vessels that will supply other parts of the body, while an arm or some other limb might not possess the usual sized artery owing to the non-use of that member of the body, and so we see that we cannot always tell by the size of the artery what the balance of the blood and other vessels of the body may require.

Special Operations Upon the Thorax.

All embalming operations upon the trunk of the body should be upon some basis which shows the requirement for such operation being made, and this must be learned thermally. What are shown under the various chapters of diseases and ways by which to operate, and so overcome

the destroying influence of single or complex disaster which may follow specific causes.



Fig. 9.—Axillary Artery and Vein under the Arm of the Left Side.

The axillary artery and vein operation may be made in two well defined modes. Fig. 9 shows the axillary artery and vein in the armpit. When operating upon this vessel the subject should be placed upon the right side, and while an assistant holds up the arm an incision may be made in the armpit by beginning close to the trunk of the body, and a little to the front of the center of the arm, where the incision may be made parallel to the inner border of the coraco-brachialis muscle, outward about three inches long by dividing only the skin at



Fig. 10.—Axillary Artery and Vein.

first and then through the fascia, where axillary vein is found and pushed back, while the internal cutaneous substances are divided, and expose the artery which may be operated upon as required.

The embalming operation upon the axillary artery and vein may be found quite as convenient and useful, as shown by the following operation:

Fig. 10 shows an operation which may be made upon the axillary artery and other vessels situated near the shoulder of either the right or left side. The subclavian artery may be reached, as it crosses and lies just beneath the axillary artery.

Operation—An incision should be made some three inches long at a point upon the lower edge of the clavicle bone, and after removing the cellular membrane and fat by the finger or the handle of the knife, we find the axillary artery and vein close together and under adipose tissue, which may contain numerous small veins that cross above the artery.

Where a low-necked dress is required by the friends, this operation should not be undertaken, and the former operation, Fig. 9, may prove as good for both low neck

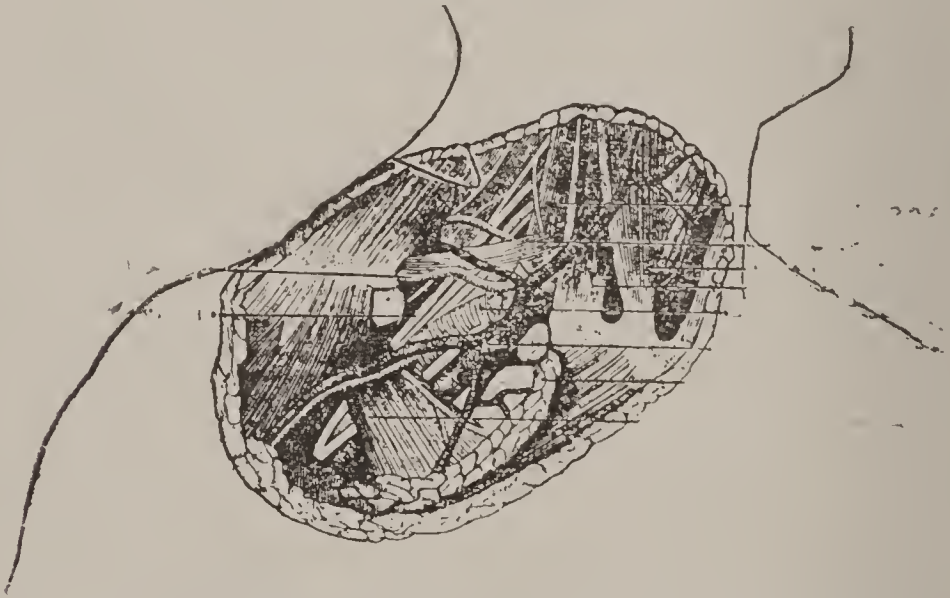


Fig. 11.—The Axillary Artery and Vein With Their Branches.

and bare arm dressings at such times as when, for any reason, we are unable to operate upon the thorax viscera from below the diaphragm.

Arteries and Veins of the Right Shoulder.

Fig. 11 shows a good view of the axillary artery and its branches, and the axillary veins and branches, after the flesh and some of the muscles have been removed, so

as to give a fairly good idea of how these vessels of circulation are constructed throughout the human body. Fig. 10 showed the axillary as operated on the left side just below the right shoulder clavicle bone, while this illustration shows both the arteries and veins and their branches of the shoulders and neck. These vessels may be injected and then afterwards emptied by either of the operations shown upon the arm or in the armpit.

I have made a specially good operation by running a knife down by the side of the neck and then by means of a twenty-inch tube rod, I was able to explore the thoracic viscera and stop their swelling or thickening process very quick and completely.

The axillary artery may be operated upon as has been described on page 59 and this illustration, Fig. 11, has been used in order to show the principle branches of both the artery and veins as they are situated under the clavicle bone which has the upper half cut away in order to show how both the larger artery and veins raise out of the thorax and pass over to the outside of the ribs.

In its upper part the axillary artery is covered successively by the insertion of the pectoralis minor muscle and higher up the pectoralis major muscle, the last being cut away, though its course is separated by a layer of adipose tissue which contains numerous small veins, and over these it is covered by the superficial fascia and skin.

The suras capular artery branches from the large vessel and crosses just above the base of the neck above the clavicle bone, while the axillary vein lies in front and to the inner side of the artery, though it is not in immediate contact with it, the cephalic vein branches



Fig. 12.—Subclavian and common carotid arteries.

above the axillary vein and passes outward just below the clavicle bone.

Fig. 12 shows the arteries of the neck, which the operator will find to vary in depth, according to the physical condition of the subject. The incision is made by beginning at the base of the neck, and care should be taken not to cut either the external or internal veins until they have been secured with a thread. The artery lies parallel with the trachea and it is enclosed in a sheath just under the deep fascia. All arteries and veins should be securely tied after each operation, then dry the wound with soda or alum powder. I sometimes plug up the deeper openings with dry cotton batten or rags and carefully stitch the wound together before leaving it. An adhesive strip placed on the stitching will finish the work nicely.



Fig. 13.—The Innominate Where It Divides into the Right Subclavial and Right Common Carotid Arteries—Also the Right Vena Innominate and the Thyroid Veins.

Fig. 13 shows an operation which by a careful study the operator may be enabled to make quick and successfully, and as this locality is in close proximity to the heart, good work may be done upon both the arteries and veins, as well as to reach the lungs by both the knife and trocar. I have made several successful operations by using the aspirator needle without making any incision. By making a small skin incision I have been able to use a strong rod and pry up the lungs and heart so as to get the infiltrated lymph and pus fluids into a space, and by this means was able to draw out this souring matter and then get the embalming fluid located so that it could control the putrifying masses of the viscera, a quick way of mastering bad cases on short time.

Fig. 14 will show the embalmer an operation upon the common carotid artery and the deep jugular vein. This operation is rather high upon the neck, therefore will be objectionable. Thick short-necked cases will make this operation somewhat difficult to make unless we can make an extensive incision. As for my choice, I prefer and would recommend the operation given on page 59. When circumstances require me to use the blood vessels above the heart; and what is more we may be enabled to raise the viscera of the thorax, or in fact remove such portion as may be found necessary by means of a hooked rod, in cases of great corpulency, and then return the flap and complete the work.

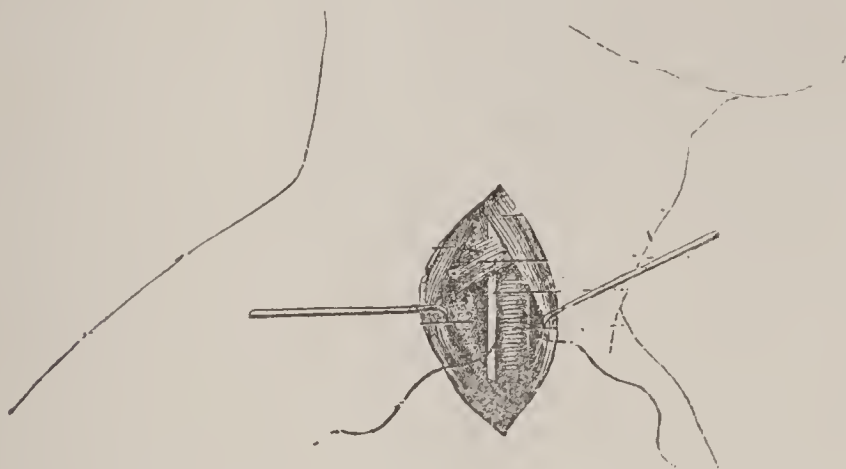


Fig. 14.—The Right Common Carotid Artery and Deep Jugular Vein.

We will next illustrate and describe suitable operation for the lower extremities. As we have shown the arteries and vein of the neck by the operations in Figs. 12, 13 and 14, and if the operator will note the sternum (breast bone), they may easily locate the places for either of these operations. As the carotid and subclavian arteries and veins are deep seated just back and under the trachea, and the artery coverings will vary much in accordance to the fleshiness of the subject, short and thick-necked persons will be the most difficult, and so the length and plan of the incision must be made to suit the requirements; and in all cases where the subject is likely to cause much trouble on account of the flesh juices, it would be better to make the heart post mortem operation by cutting and raising the sternum bone in such a way as to permit the large veins and arteries being operated upon and so emptied of the blood and echmosis fluids.

Minor Operations Upon the Lower Extremities.

As most embalmers know how to locate and raise the femoral artery, we will show other operations which for many reasons will become quite as important. Fig. 15 will show the main artery as it branches to the front and continues downward, and this branch is called the Anterior Tibial and in the front part of the foot it is known as Dorsalis Pedis artery, where the vessel curves



Fig. 15.—Shows the Anterior Tibial Artery and the Dorsalis, Pedis Artery of the Right Foot.

or arches toward the outside and sends out smaller branches to each toe.

The small arteries may be used for testing the completion of the arterial vessels by making a slight gash between the toe and finger, will show whether the pump is sending the solution to the various parts of the body or not. Both the deep and superficial veins will be found in close proximity to the arteries.

Operation on the Foot.

The dorsalis pedis artery is shown at Fig. 16 and the artery is not a difficult operation when once we learn how to locate and raise it, while there are many admirable and convenient features which recommend it as being both a practical and unobjectionable operation.



Fig. 16.—Shows an Incision as Made to Raise and Operate Upon the Dorsalis Pedis Artery.

Location.—The dorsalis pedis artery terminates the anterior tibial, and runs in a line drawn from the middle of the intermalleolar (ankle space), measured from the extremities of the malleoli to the space between the first metatarsal bone. It is covered by the integuments, fascia and intermost tendon of the extensor brevis digitorum; on its inner side is the extensor proprius pollicis and external the inner tendon of the extensor longus digitorum muscle. This artery has veins which are in close proximity.

Operation.—An incision is made two inches in length

on the line indicated, and should parallel the external border of the tendon of the extensor proprius pollicis muscle. The skin and deep fascia should be divided on a director when the internal division of the extensor brevis digitorum muscle is shoved to one side and will then expose the artery and its two veins, when they may be raised and injected, provided, that no rupture, clot, or disarrangement may exist so as to interrupt the direct flow of the embalming solution.

Popliteal Artery and Vein.

Fig. 17 shows the popliteal artery operated for at the inside and below the knee and through the deep fascia and under edge of the tibial bone. The saphenous vein will be found near the artery.

Operation Below the Knee.

Location.—As the femoral or trunk artery of the leg passes downward the division known as the popliteal artery extends from the opening in the abductor magnus muscle to the lower border of the popliteus muscle in an oblique direction downward and outward.

The anatomical relations of parts in the popliteal space are as follows: The external saphenous vein runs perpendicularly in the median line and in the middle of the popliteal space where it perforates the deep fascia, then ascends and winds around the popliteal nerve and empties into the popliteal vein.

The popliteal artery is covered in its whole course and crossed at the middle of the popliteal space by the popliteal vein, which always covers the artery. They are covered by semi-membranous and cellular tissue as it passes the two heads of the gastrocnemius (knee bone) downward.

Operation.—The popliteal artery and vein may be raised as follows: Raise the knee so as to flex the muscle and feel for the internal side of the muscle of the inside of the leg and below the knee and make an incision some two inches long from the bone downward and parallel to the shaft of the inner border of the tibia bone. The finger should be used to guard against cutting the

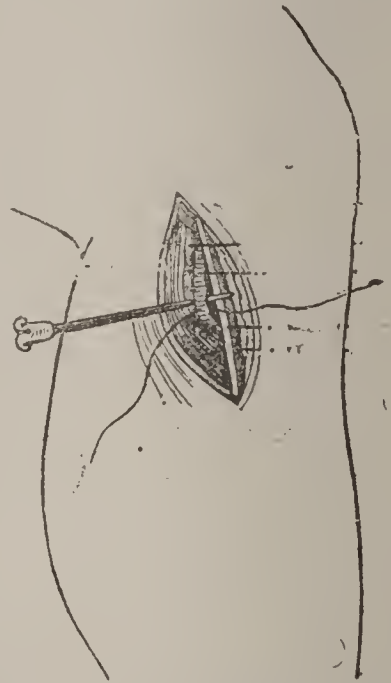


Fig. 17.—Popliteal Artery and Long Saphenous Vein.

superficial and other veins and open up the inter-muscular septum and draw the muscles backward when the artery and vein may be seen at the bottom of the wound.

This operation may be made at points lower down and by this means avoid such exposure as that caused when operating upon the femoral artery above, when there can be just as good work performed unless it becomes necessary to operate directly upon the large blood vessels within the trunk of the body. While there may be reasons when the anterior tibial artery would be preferred on account of the convenience as the operator may be made without disturbing or moving the limb very much.

Anterior Tibial Artery and Vein.

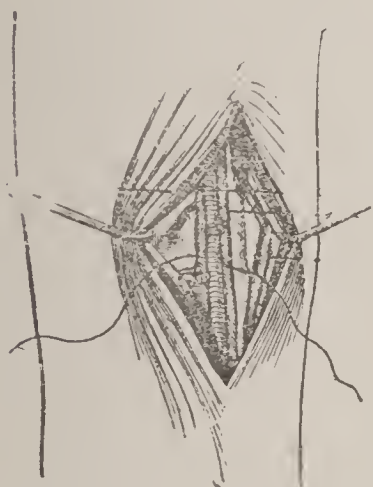


Fig. 18.

Fig. 18 shows an operation on the front side of the leg and just below the ligaments of the knee where the anterior tibial artery may be taken up and both this artery and vein may be operated upon below the knee in quite a satisfactory way.

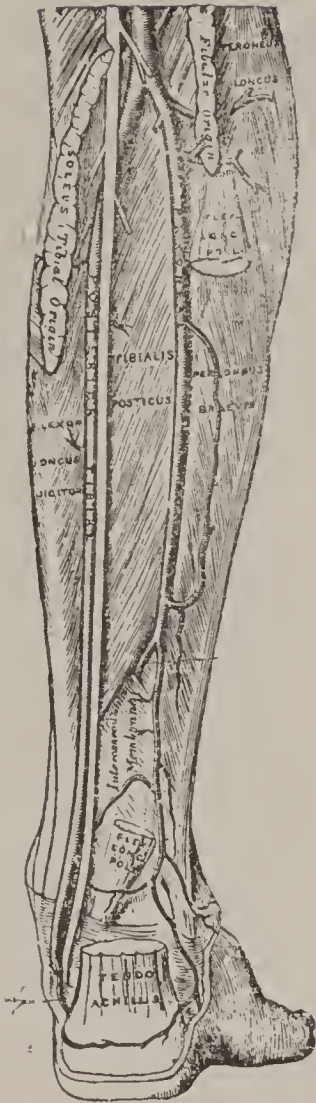
Location.—In the middle third the anterior tibial artery is covered by the skin, superficial and deep fascia: On the inner side it has the tibialis muscle and on the external side the exterior longus digitorum and the

and the extensor proprius muscles.

Operation.—Raise the limb at the knee slightly and block it up, then make an incision in the course of the artery through the integuments: then flex the foot slightly if possible: when the muscles tibialis anticus and the extensor longus digitorum may be parted so as to expose the artery and vein.

Popliteal and Posterior Tibial Arteries.

As we have shown on page 66 how the popliteal artery passes through and below the knee and Fig. 15 shows the popliteal artery and its branches to the front part of the leg. Fig. 19 will show the popliteal artery and its branches in the rear of the leg. There are two branches, the smallest branch is called peroneal artery while the larger one is known as the posterior tibial artery.



The posterior artery has been shown above, while Fig. 20 illustrates how an incision may be made to raise one of the principle branches of the popliteal artery where it terminates behind the internal malleolis (ankle) running at first parallel with the tendo-achillis and then midway between the internal malleolis and the tuberosity of the os calcis it is here very superficial and lies in close relation anteriorly with the tendon of the tibialis posticus and posticus nerve. It has venae comites.

Operation.—The foot is placed so as to relax to the internal side when an incision may be made some two inches long just behind the edge of the tibial and parallel with it. The integuments are divided, the deep fascia mass of fat is opened when the artery and venae comites will be exposed to view, though it should be noted that the artery is sometimes found anterior to the incision here described.

The artery may be traced and operated upon by following the tibia shaft upward, when the muscles and other integuments may be divided so as to expose the artery as it lies deeply under them. *See Fig. 21.*

No. 19.—Posterior Tibial Artery and the Peroneal Artery.



Fig. 20.—Posterior Artery.

Operation upon the Posterior Artery and Vein.

Fig. 21 shows an operation upon the posterior tibial artery and vein behind the leg and which may be used under certain difficulties, such as broken and mashed limbs, or in case where canula tubes are to be inserted into the veins and left to drain for the night in certain large or drowned cases, or when the body may be found in the advanced stages putrescence.

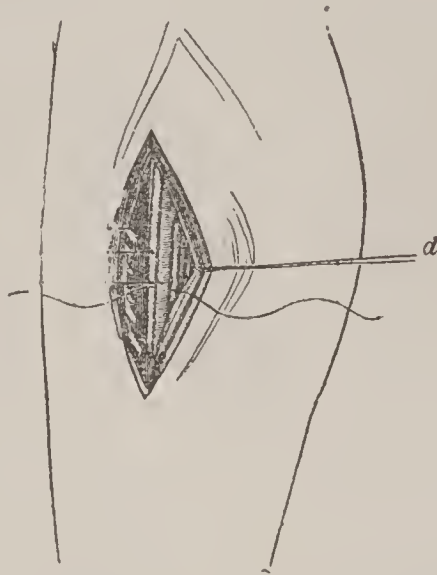


Fig. 21.—Posterior Tibial Artery under the knee and behind the leg.

Special Operation upon the Abdominal Cavity—Femoral Artery.

The femoral artery and its accompanying vein may be operated upon at Poupart's, ligament where both are superficially close to the skin, though the fleshy condition

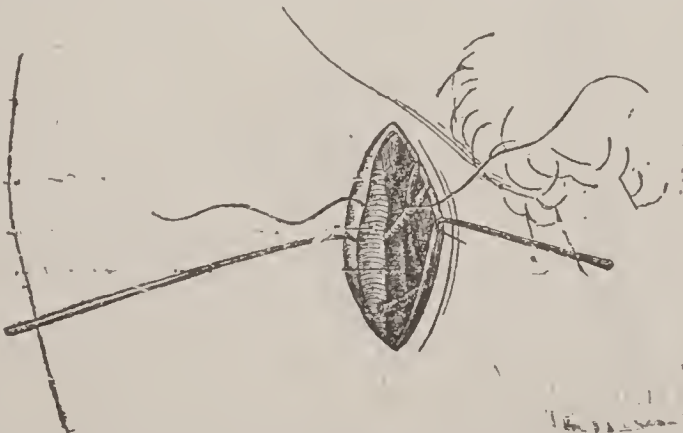


Fig. 22.—Femoral Artery and Saphenous Veins.

of some persons may vary the actual depth much in accordance to the physical structure.

Fig. 22 shows the femoral artery and long saphenaous vein which lies just to the inner side of the artery. They are covered by the skinny superficial and deep fascia and the lymphatic glands. In fleshy persons the fold of adipose may greatly overlap the space known as Poupart's ligaments. However, there ought to be no great diffi-

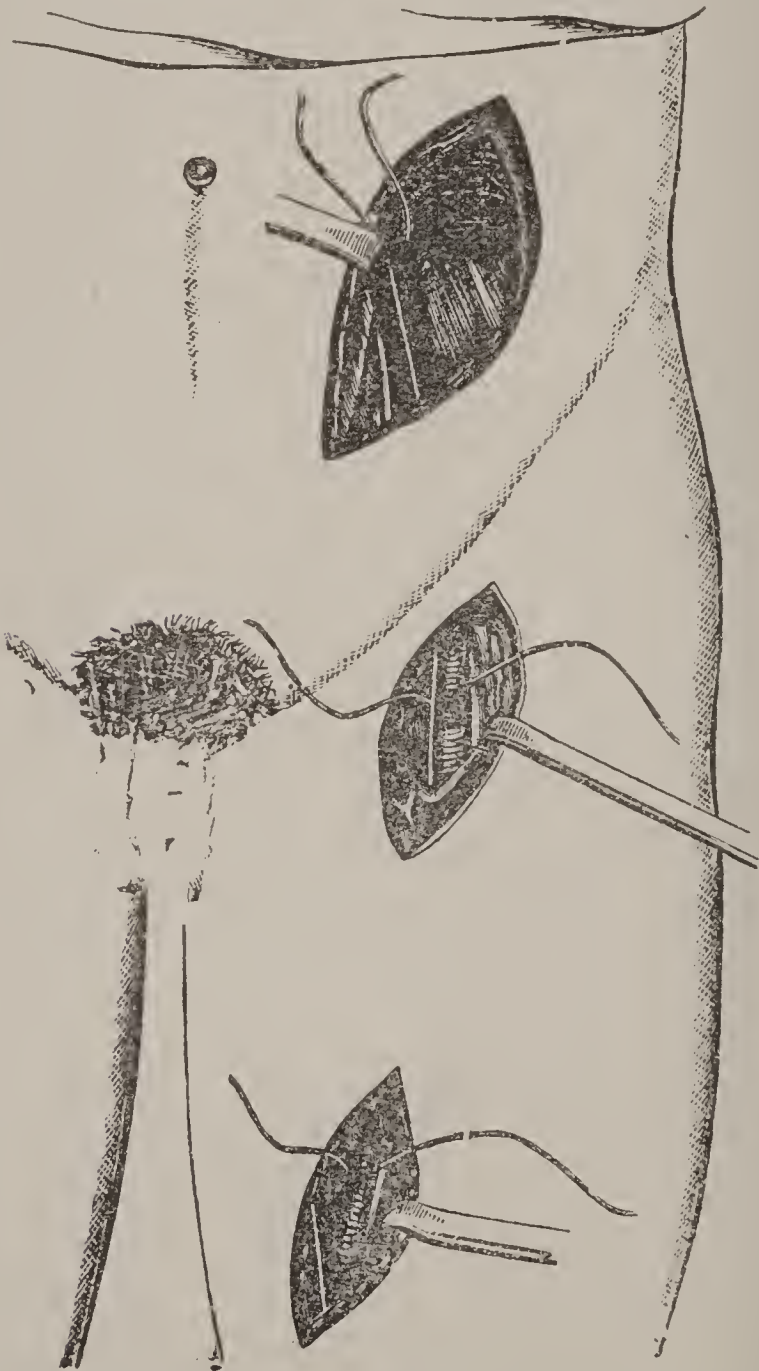


Fig. 23.—Operation for the Primitive Illiac Artery and Vein, and the Femoral Artery and Vein at two places below.

culty in reaching the artery by an operation which may be made at a point lower down as shown by the next illustration.

Primitive Illiac Artery.

In order that the embalmer may be able to clearly understand the principal blood vessels as they extend from the trunk of the body outward and how this may be reversed as the embalming fluid or the long flexible canula or rod may be directed into the larger vessels. Fig. 23 shows this as raised at these points either one of which may be used for clarifying and removing the body fluids and refilling them with the compounds, as are anti-septic and preserving agents.

The upper incision shows the abdominal artery known as the primitive illiac artery. Either this or the femoral artery or vein may be used for inserting the long canula or gum tube, which by using care ought to be made to reach the fluids below the heart, where the blood, if not clotted too much, may be pumped out, though there might be some obstruction like that caused by rigor mortis. Some tumor or engorgement may press the vessels too greatly to allow the instrument to pass along as freely as they will require or some fevered condition may leave the veins collapsed and glued together at some point so as to not permit of them being opened again without we use some weak solution of soda and acid to again soften them up. While with the arteries, they may become so small by reason of non use, or that of a fatty or some other deposit, while blood clots and rupture may render the large arteries unfit to conduct any fluid through them. See Prof. R. W. Hussey's process given in the March number of 1893, *Sunny Side*, as taken from the *Embalming Monthly*.

As a rule the better operations may be made after the

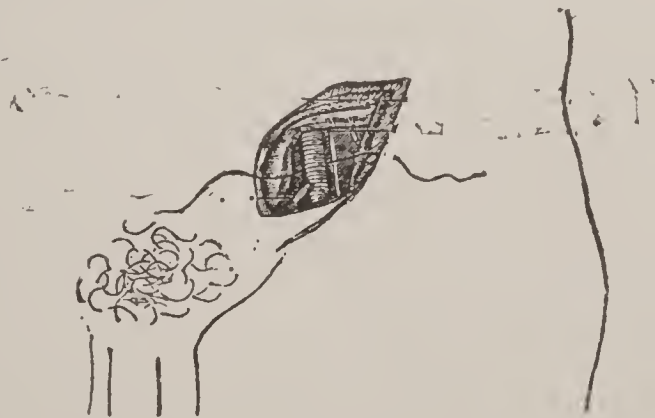


Fig. 24 —The External Illiac Artery and Vein.

rigor-mortus has passed off, or when warm water and the above soda solution is used for softening and cleaning the blood vessels of the putrescing body fluid which they and the capillary vessels may contain.

Operation upon the Abdominal Arteries and Veins.

Fig. 24 shows an operation for the external illiæ artery and vein. When necessary the abdominal wall may be operated upon by making an incision three or four inches long and after cutting through the skin and fibers of the abdominal wall, we may slightly open the peritoneal or lining membrane of the abdomen in order to discover the presence of gasses or nasceous fluid. After drawing this out, we may secure the artery and vein and when there is any difficulty like peritonitis or some bowel trouble, tumors, kidney trouble and similar classes of disorders. I would recommend the liberal use of the exploring rod and stir up the abdominal organs and by this means make a way to get at the sour fluids or gases which may have accumulated there. This abdominal operation may be performed fairly well as low down as at Pouparts ligament. *See Fig. 22.*

The Physique and Its Tendency to Putrifaction.

(*See diseases.*)

In order that the reader may fully understand the principles by which deceased bodies vary in keeping, I give an illustration (Fig. 25) from Gray, as this shows clearly how the lymphate glands and flesh juice are provided with minute vessels that supply every fleshy substance of the body, as they not only co-operate, but become a part of the vessels which circulate the blood.

All full, round forms and fleshy persons have not only proportionately large arteries and veins, but they have a corresponding fullness of the lymphate fluids and fatty glands, and when there is no emaciation of the body, these substances are sweet, albuminous and oily, admixture with a large per cent. of water.

A nominal proportion or roundness of form is called normal; an over size, corpulency or abnormal condition, due to an over deposit of glands and fleshy or adipose cellular substances. While this condition is not called a disease, it will ultimately result in disease of some form.

Emaciations are the opposite to the normal roundness of form, and may be due from several causes—want of proper food, over exercise or some disease which interferes with the natural functions of life.

In order to be able to embalm this class of bodies, we must know that there will be several classes of hindrances.

Perhaps the greatest one may be shown in that class of diseases which destroy the arteries by reason of some fatty degeneration or ulcerations, and in either case they will rupture these vessels and organs of circulation, or they may clog up and become glued together, or some abscess may be so situated as to render both the arteries and veins unfit to convey the embalming fluid through all parts of the body.

A long stage of sickness does not signify what the physical condition of a case may be, while the class of the disease always does to a very great extent. Yet this may be modified by reason of some intervening causes, such as may be shown in various complicational diseases, and this being true, the embalmer must become well informed with the resultant condition of all classes of disease which end in death, if they would become fully qualified as embalmers, and in no other way can they ever be enabled to meet all the emergencies which will come up to be mastered, only by a thorough knowledge of the internal physical conditions of each subject which they undertake to operate upon.

For the embalmer to inject a quart of embalming fluid into the arteries and as much more in the cavities gives him no reliance that the body is embalmed, for in either case the fluid may be found in some single cavity or place, while all other parts of the body has no chemical or preserving fluid at all. *See chapter on Apoplexy.*

In considering the questions of the flesh juices in all deceased bodies, we may say that the greater proportion of them are found within the small vessels and cells of the lymphatic system, and after the body has been through the rigor-mortus stage, these fluids become more watery, as the albumen and other substances begin to break down the fleshy cells, and soon a souring process takes place and thickens every fleshy substance of the whole body. Large strong arteries will convey the embalming fluid to all parts of the body; provided, there are no ruptures, abscesses or blood clots to interrupt the process of injecting it, and when the fleshy texture is found porous and open grained enough to receive it. But what I would have my readers note is that class of body conditions which do not receive the embalming fluids readily, and this is not alone in ruptures or abscesses, so much as by the flesh cell formations.

All soft and close grained flesh is so fine in its structure and so deep in substance of fats, oils and cellular tissue that no fluid can be injected into such parts, and therefore there can be no embalmment, only by a slow process of absorption, or by the natural process of chemical assimilation, and in order to embalm one of these bodies we must use a chemical compound which will have a strong affinity for the water, oil and albuminous substances which surround the extreme ends of the arteries in the viscera



Plate No. 1.—Abnormal Physique.

and deep fleshy parts of the body, and the greater the quality of these fatty cells and albuminous substances the greater will be the difficulty that the embalmer will experience in operating upon them. This is not so much because of the free flesh juices as in those soft fatty cells which will soon break down into ammonial gas and so become watery and putrid.

The lowest that deceased bodies can be classed is two distinct classes—the coarse grained flesh texture, and the fine soft grained flesh texture.

The first may be readily embalmed when the arteries are in good condition and we use a good embalming fluid, But nothing less than a strict scientific and methodical process will enable any operator to embalm and preserve the last. Plate 1 shows a large body, and while the great size and fullness of all parts of the body signify a soft and close grained flesh tissue, yet there may be a more porous and open grained flesh that will absorb the embalming fluid and so yield to arterial embalment under good and skillful management. However, the Egyptians failed to show us any specimens of this class of bodies; therefore we do not believe that they knew of any embalming process that would preserve them, other than that of using oil of cedar, and so destroy all the internal flesh and fluid substances, and while the modern embalmer may do the same thing, and this in less time than the Egyptians required. But modern ways and observances of funeral rites does not require that class of work, so we must look for other sciences, and in doing so we find that this involves both analytical chemistry and bacteriology; therefore we must drop the subject, for it is one far too vast for this book, and since we know that Professor Renonard, of New York; Professor Hohenschuh, of Iowa, and perhaps some others, are now engaged upon this special study We look forward with no small hope that they will soon throw new light upon what I said about keeping such bodies through the column of the *Casket* some 15 or 18 years ago.

But by reviewing the subject in hand we will now try to look into the question of ways and means by which to perform good general operations of embalming, for while we have studied the many plans for doing surgical work, yet there remains so much of the most intricate responsibilities for us to act upon by both good judgment and knowledge in order to justify us at all times and places—so the embalmer must become thoroughly acquainted with the human structure.

The Lymphatic System.

Fig. 25 shows the deep lymphatics and glands of the face and neck, and we might also see how the small vessels take the lymphatic fluid from the axillary and other arteries, as this fatty substance builds up the glands and surrounding flesh tissue. These substances contain lymph or a transparent watery fluid, which, if analyzed, would show the presence of sugar, albumen

and oil, and when this substance sours it takes on a gaseous state and so thickens the flesh cells around it. Next the flesh tissue begins to soften and grow watery, and all parts of the body take on rapid changes caused by various species of bacteria, and becomes involved into ammonial and other gases, which takes it

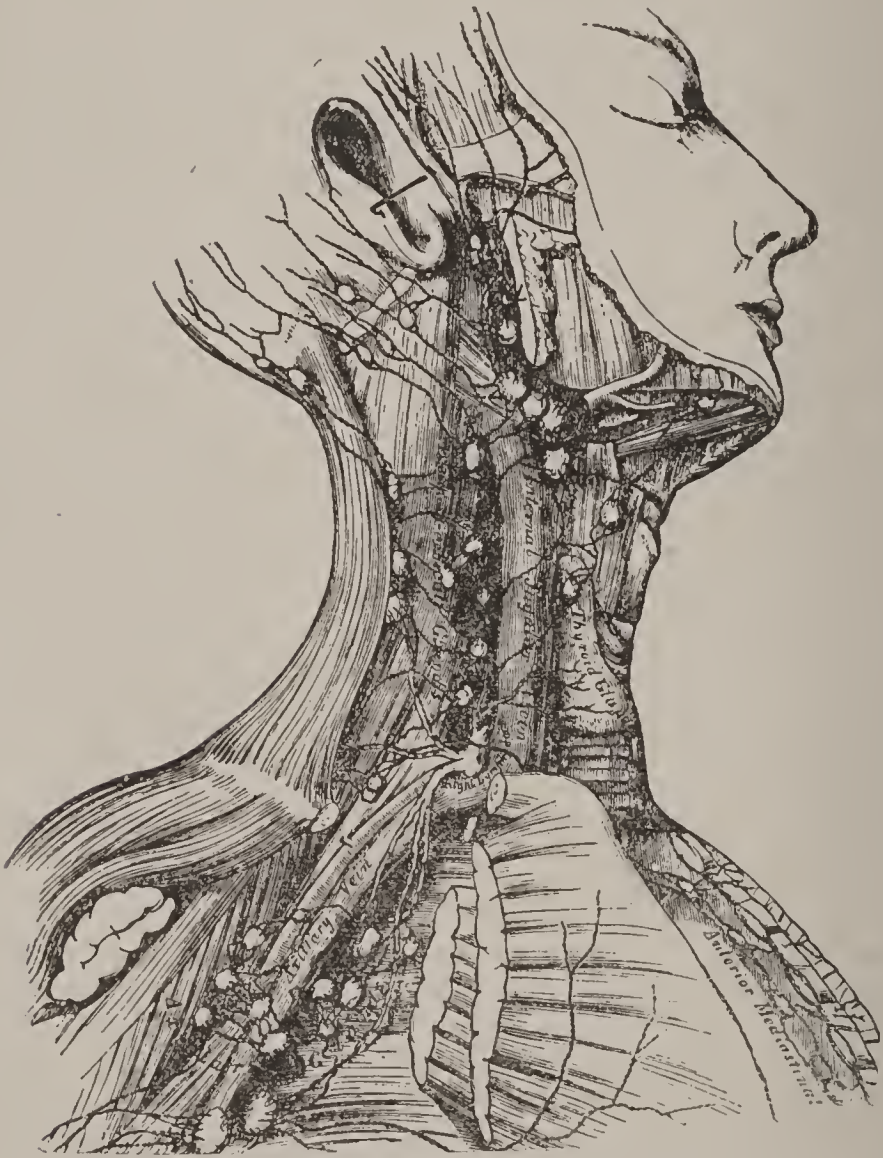


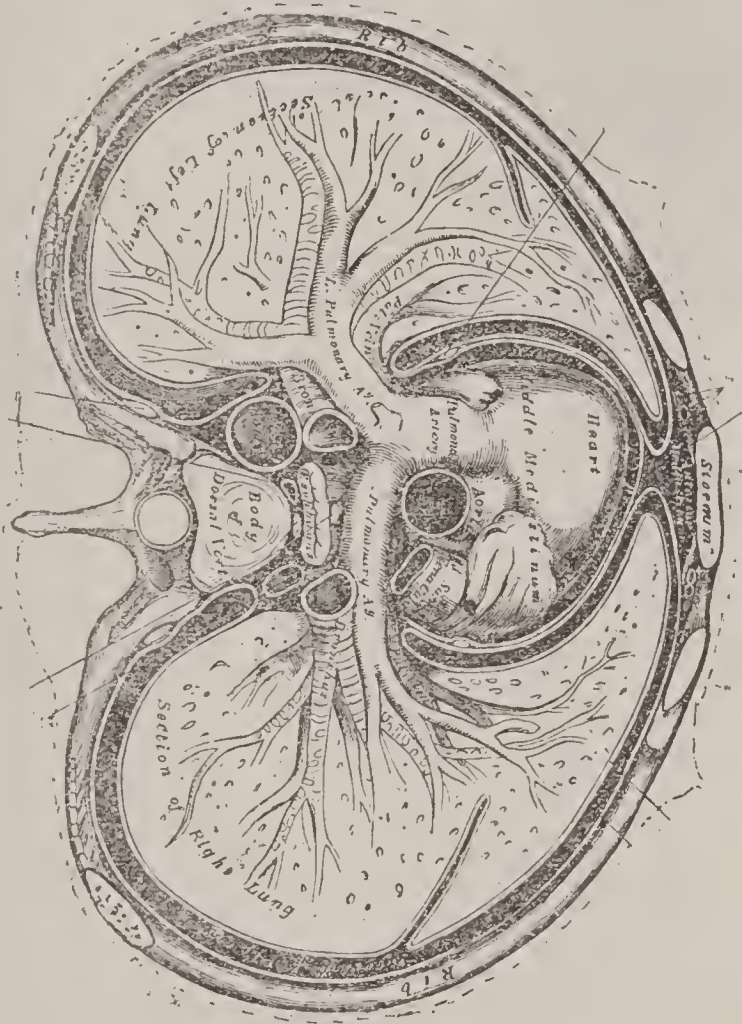
Fig. 25.—The Lymphatic Fluids.

back to the common elements of nature, and as all the lymphatic vessels are like a great chain of fine net-work, we find it very difficult to reach these substances, with such chemicals or drugs as would neutralize the fermenting process. In order to show the location of the heart and lungs, and the complicated way which the blood vessels are surrounded, I take the following illustration from Gray :

The Thorax.

Fig. 26 shows the relative position of the viscera and the reflections of the pleura, or lining membrane which covers the lungs and returns as the lining walls of the thorax. Serous fluids may accumulate in the cavity before death, and afterwards cause the face to blacken by depressing the blood vessels. The heart is also invested in a sac like membrane called pericardium. Serous fluid may engorge this when diseased. The embalming fluid cannot come into contact with the serous fluid should there be any in either cavity, and this may become sour if not removed or brought into direct contact with the embalming fluid, by the cavity process.

Fig. 26.—The Viscera of the Thorax.



But the danger of this operation is in the fact that what fluids are forced into this limited space, it may so depress the large blood vessel, and so blacken the face in the same way which the lungs and other viscera would do, when they thicken or swell up by the putrescing condition or process of fermentation.

In all classes of both young and old, we must keep the viscera

of the thorax in as nearly a normal state as possible by removing all infiltration, both inside and outside of the lungs and heart—and then the embalming fluid will be more likely to assimilate and destroy the serous and albumin process of dissolution, and so gives good results by reason of the surgical or aspirating treatment, as well as by the influence of the chemicals that are used. *See diseases of both the organs of circulation and respiration.*

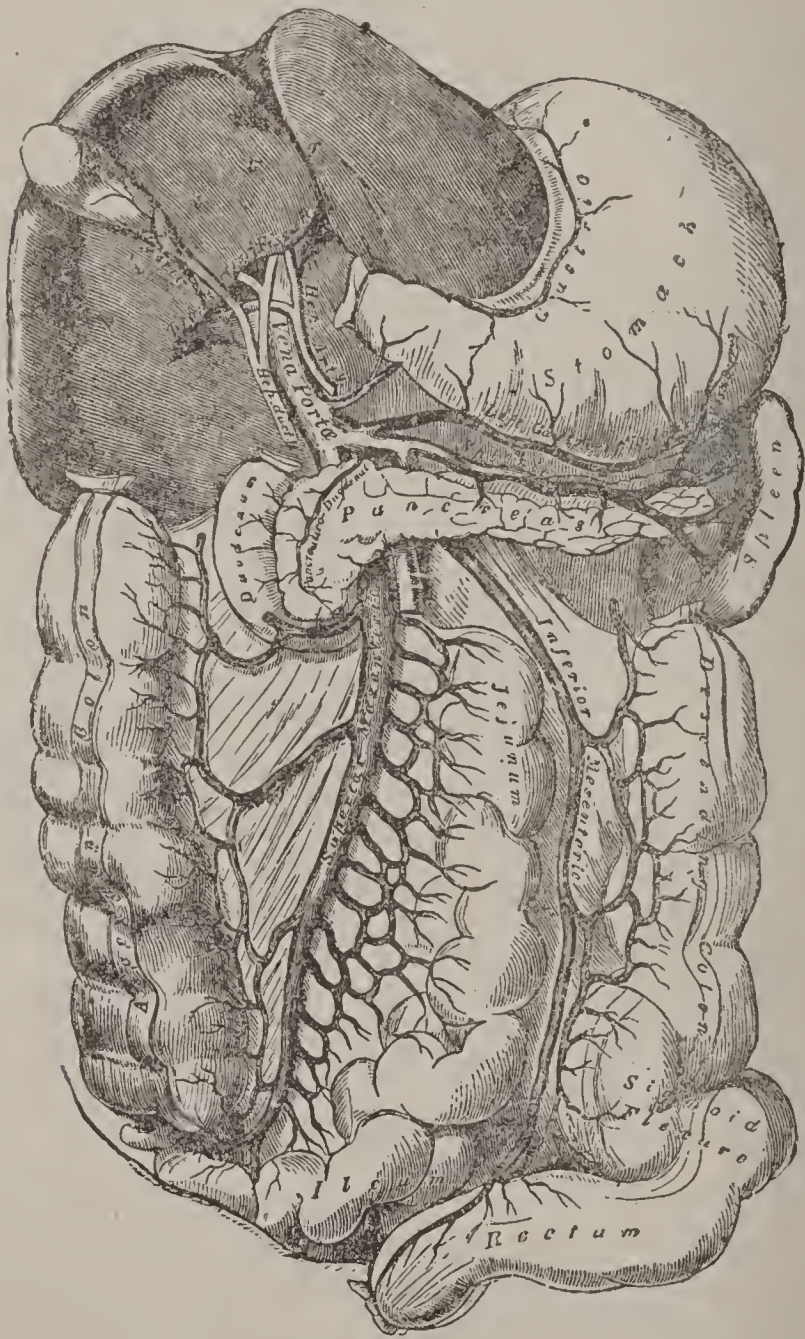


Fig. 27.—The Abdominal Viscera.

Abdomen.

Fig. 27 shows part of the venous structure of the abdominal viscera after part of the transcolor has been cut away. *See Fig. 30, page 82.* The inferior vena cava and its connections with the kidneys lie behind the duodenum and opposite the eleventh rib and under the peritoneal membrane which lines the abdominal cavity.

The cardiac and portal veins are associated with similarly large abdominal arteries, and by their numerous branches these arteries and veins involve all the abdominal viscera, together with all the adipose tissue of the abdomen. While to explain farther there is a similar network of vessels of both the superior and inferior mesenteric system. Fig. 27 shows only the portal vein and the inferior mesentery.

As the mesenteric system is associated with the lymphatic system, I will say that it is because the mesenteric vessels provide the chyle and lymph fluid for all body nutrition through the arteries. While on the other hand the kidneys expel all waste material found in the blood as it is returning through the inferior vena cava. There are several forms of diseases caused by various uric disorders. While with the mesenteric system the glands called peyer glands become the seat of diseases, like typhoid fever, when the membranes may be eaten through by small perforating sores. While with the urinic disorders an abscess or some similar derangement of the kidneys or its associate membranes may destroy that portion of the abdominal viscera.

In the normal condition of life the mesenteric and lymphatic system abound and give roundness of form to the young and growing, and following in after years much in accordance with the personal ways of life, though varied somewhat by some unexplainable reason which go from the ordinary to that of an abnormal physique. *See chapter on disease.*

As the reflection of the peritoneum makes several cavities as it surrounds the various abdominal organs, I desire to call especial attention to this fact in order to show the embalmer how easily it is for them to be mistaken about where the embalming fluid is located after they have injected the abdomen at some one or more places.

It will always require the sharpest pointed needle or trocar in order for them to penetrate this thin and strong membrane of the peritoneum, and as this is reflected so often and variedly, one may be greatly deceived, because there will be many times when a blunt trocar or needle will only push it back instead of punching through.

Fig. 28, page 80, shows the reflections of the Peritoneum. The name means "to extend around." This is a serious membrane which covers the walls and viscera of the abdomen, like a shut sac, but not completely so in the female. As I have said above, there are so many reflections and diverging layers of the delicate membranes that may be easily pushed back by the

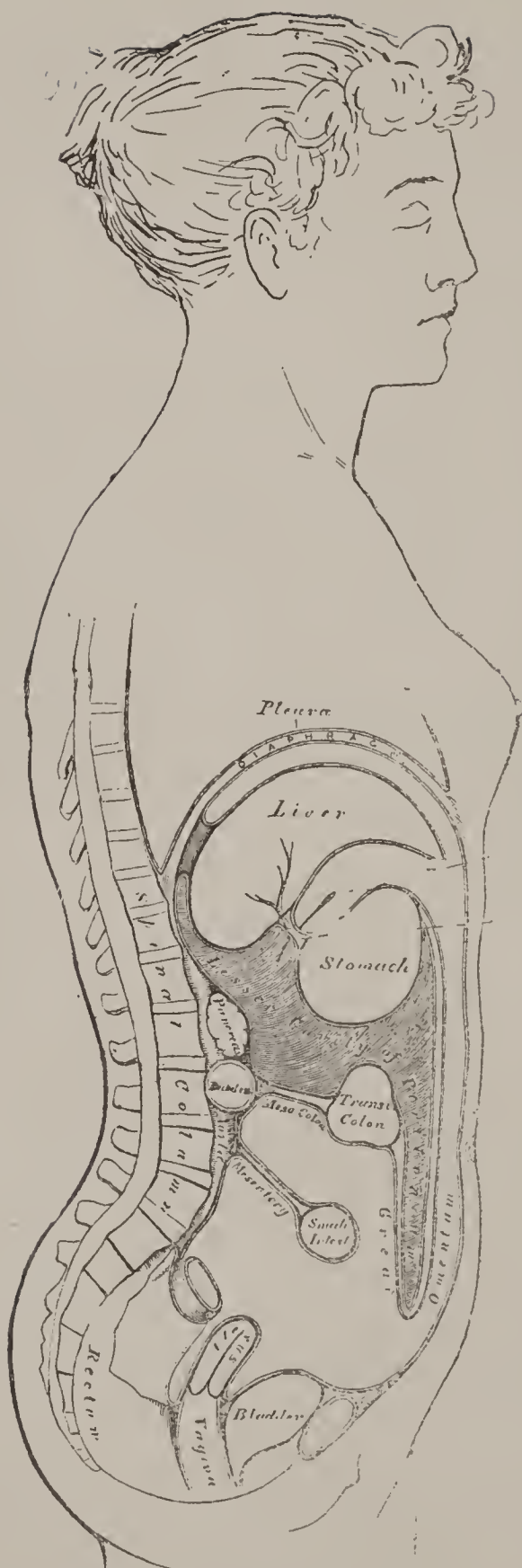


Fig. 28.—The Peritoneum.

needle, so that the embalming fluid is collected into a single space and so it cannot reach all parts of the abdomen as it should do. The reader should study the picture well, and when possible investigate every detail of this and the diseases which pertain to this part of the body.



Fig. 29.—Large Veins and Their Branches of the Head and Neck.

The Veins of the Neck and Face.

Fig. 29 shows the large veins of the neck and face, and these correspond to the large arteries which supply the blood. They are called external jugular, posterior jugular, anterior jugular, in-

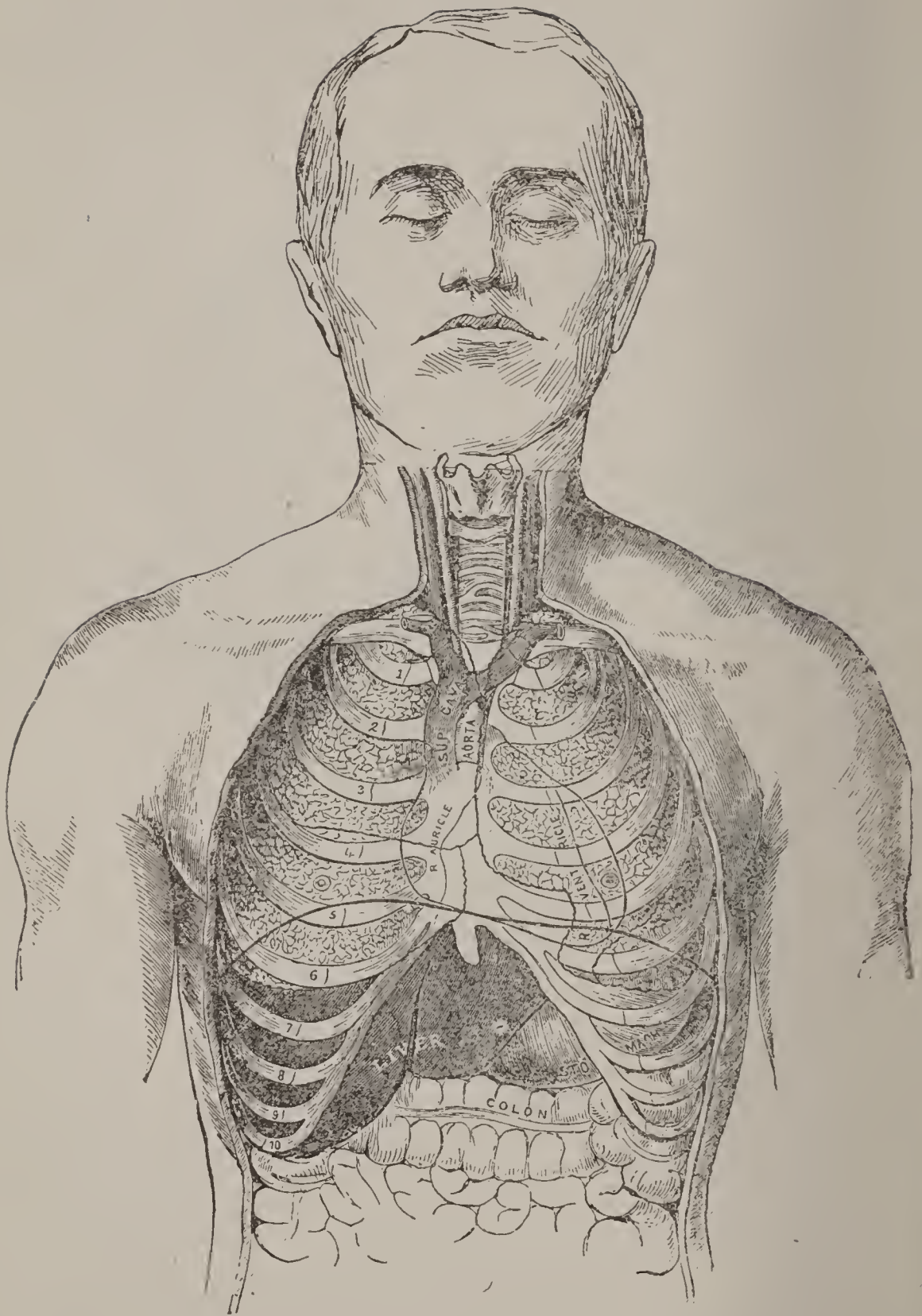


Fig. 30.—Front View of the Thorax (Gray).

ternal jugular and vertebræ veins. The office of the vein is to collect the nitrogenized blood from the capillaries of the flesh cells and return it to the right side of the heart and into the lungs, where it discharges the nitrogen and becomes arterial blood by taking up oxygen. As a rule there will be more or less fluid of the body which will settle in the region of the heart, at time of death, and when the venous blood sours the fibrine may change it into an inky color, probably due to the large amount of nitrogen which it may contain. If there is any great quantity of this echmosys fluid settled within the large veins near the heart, it may be discovered by a slight pressure upon the abdomen and chest, which will cause it to flush the face more or less. *See page 81.*

Location of the Thoratic Viscera.

Fig. 30 shows the front view of the thorax (Gray revised). The embalmer should learn not only the numbers of the ribs, but should learn the exact locality of each organ of the thorax. In fact, all who desire to become professional men should study both Gray's anatomy and Dalton's human physiology, published by Henry C. Lee's Sons, Philadelphia, Pa.

This cut illustrates the locality of the viscera, as the transcolor, stomach and liver are clearly shown, while the lines show the heart and location of the arch of the aorta. And also the superior vena cava and jugular veins. Where this vessel and its branches can be properly emptied of the inky fluid after death, the face will not, as a rule, flush and become black for some days, and should it do so afterwards, it will be caused by the ammonial process of dissolution. *See 82.*

I am not a doctor nor a student of medicine, but I soon found that to become a modern embalmer, a specialist, it was necessary to begin where all the sciences of medicine ended. While anatomy, morbid pathology and chemistry provided me with the first steps to embalming science, yet there was much of these sciences which were irrelative, and so it became necessary to begin the work of making special classes of observations, and by this means prove all plans and processes by a common law of method by which to govern that work.

As the laws of time and nature end all the remedies of medicine and surgery, so the embalmers must also be governed by these common laws of dissolution and decay.

Special Instrumental Treatment.

How to use the Aspirator.—In all such diseases which attack the various organs of both the thoratic or abdominal cavity it will be necessary to make use of instrumental means in order to remove at least part of the pus fluids and infiltration which the attack of the disease may have created singly or collectively. In 1874 the author improvised an aspirator by using a pewter syringe and rubber connection to both large and small metal penstock

tubeing for canula, while a shapened iron rod was fitted into these tubes for trocar uses. This instrument was a success, excepting that the canula was short by one half.

Diseases of the lungs, heart, kidneys, bowels or the lining membranes which surround them, may give the embalmer many extraordinary experiences because of the many classes of clots, irritation, infiltration and engorgement condition that may be found present or soon will show, as they follow with a long list of disastrous consequences.

Empyemal effusions into the pleural cavities will often require a carefully directed puncture of the thoracic walls in order to get rid of the fluids which has collected in some particular locality.

Dr. Howe tells us that the symptoms indicating fluid in the pleural cavity are shown in life by difficulty of breathing, coughing, pain in the chest and especially a fullness on the suspected side.

As the chest is stripped, the embalmer not knowing the patients complaints, will be enabled to see the marks of the disease as he finds that the spaces between the ribs are filled and bulging, and this is caused by a dropsical infiltration in what the surgeon knows as the subcutaneous areolar tissue. The distended half of the chest is heavy on percussion and the fluid may be heard to gurgle as the body is moved slightly to one side.

All liquid accumulations in local organs or cavities must receive various degrees of special attention before any one can lay a just claim to doing scientific embalming.

In cases of pneumonia there has been as much as three quarts of pus removed from the plural cavity in less than ten minutes by the use of the knife on the swollen side between the eighth and ninth ribs and so low as to be quite under the seat of the engorging abscess.

A large trocar would serve to remove this pus fluid, but a small one would hardly do as well unless some other liquid was used to partially dissolve it in case that the pus was of a thick mucous character. School children as well as older people require special study. For diseases like the above and that of peritonitis, pluritis, and other diseases as they are shown to end in death in the chapter relating to these diseases according to their classes.

Fig. 30 shows an operation called by physicians "paracentesis thoracis" which is recommended and used by Drs. Hamilton, Agnew, Howe, and in fact, all other intelligent and skilled surgeons for relieving the patients under some varieties of local diseases that we cannot enter into the further detail, as we must confine this chapter to the many great advantages and uses of the aspirator in the special scientific work of embalming.

My plan for introducing the canula has always been upon the theory of getting at the lowest point of the pus fluids and then by pressing and shaking the body get the lighter floating liquor down and out. As various organs or local cavities require special operations in order to reach and empty them, so I will refer the reader to the study of the local organs and their diseases.

Abscesses, clots, adhesion and cohesion may each require that some softening or thinning solution be used before the pus contents of the surrounding tissues will permit it to flow or be drawn off. Solution No. 3 will do for the mucous pus, while solution No. 4 may be used to soften the surrounding tissue or cohesions of veins and smaller arteries.

Diseases like uremia, Bright's disease, dropsy, foetal disorders and tumors should all be treated with solution No. 8 before the fluids of the body can be all removed as it may be by the aspirator and other instrumental operations, and after this is done the embalming fluids can be injected in such a thorough way as to make the embalment more secure and perfect.

In black thick blood and plethoric cases the face appearances may be improved by injecting the veins with this simple solution, as this will cut the mucous or geletine and oily substances as well as the blood clots so that the blood and other fluid substances may be pumped out when the embalming fluid can be introduced with better results.



Fig. 31.

Dropsy is understood to be an infiltration of serus fluid into areola spaces and serus cavities of the body. The blood of the venous system becomes watery and soon obstructs the whole system more or less. Fig. 32, page 86 shows how physicians introduce the trocar and canula and draw out the fluid. During the evacuating procedure the canula may be obstructed by a flake of lymph or floating folds of intestine and it may be necessary to use a probe. When the embalmer is satisfied that there is fluid which will not flow out, introduce the canula at several other parts and drain other cavities. So rapid is the accumulation of serum in some instances that I have had to go over the work soon afterward because of the breaking down of the lymphatic and flesh cells which sour and become fluid and require their removal again. As not only dropsical cases, but there are many other cases which from either the disease or the physical condition will require some hours of time and careful attention before they can be rendered safe and securely embalmed; yet, by intelligent management and a due amount of patience, no skilled embalmer should fail when once they are given the required time; which each case for specific reasons may greatly vary in both the time required as well as for special facilities that may be demanded by reason of some specific physical causes. With all embalmers, heretofore, the plan has been to introduce the long tubes into both the thoracic and abdominal cavities from the top or near the center. With my plan it will be found very much better to introduce the needle,

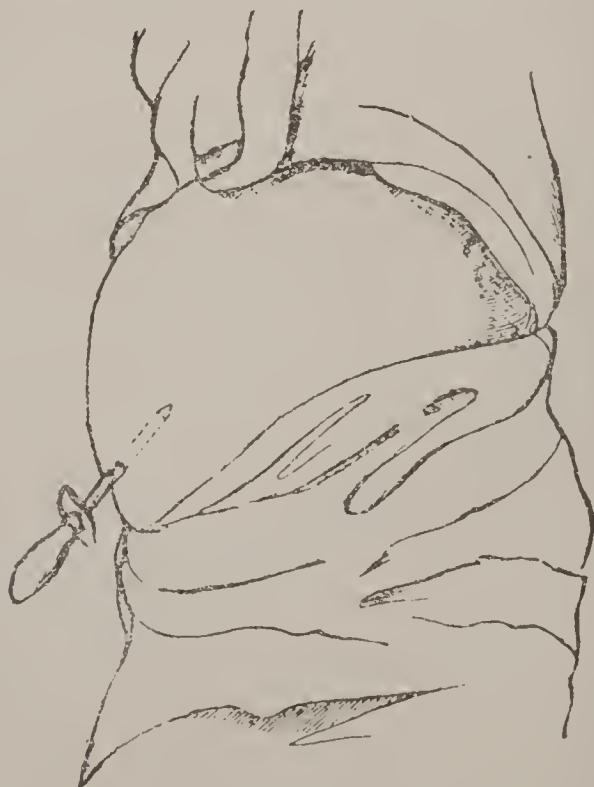


Fig. 32.—The Physician's way for Tapping the Abdomen with Trocar and Canula in Dropsical Cases.

tube or trocar at the side and lower down than at the point or bottom of the cavity which may contain noxious, watery fluids.

Dropsy.

Tapping the abdomen is one of the most common embalming operations and there are so many times when we fail to remove all the infiltrations in such cases as in dropsy, Bright's disease, albumenaria, tumors and pregnancy. While fairly good results may come from the use of trocar as shown in Fig. 31, the rule is that there cannot be enough of the noxious fluid drawn off by center abdominal operation, and I would advise all to use the side method for aspirating each of the above and similar afflictions.

In Dropsy and similar cases the trocar and canula is inserted in the medial line two or three inches below the umbilicus when the canula is pushed nearly to the hilt in order to perforate the peritoneal membrane, when the fluid will run out, though care must be taken to keep the fold of omentum from closing the canula opening, and the embalmer will be likely to experience the same trouble while trying to aspirate this fluid.

Physical Obstruction as Found in Women.

Perhaps there is no class of diseases which end in death that has more disastrous complications than of several ailments which woman alone is subjected to at various periods of life.

The first may be at the early age of puberty, when cold, wet or nervous shock may result in the suppression of the menstrual discharge and so cause an affection called amenorrhœa, while plethora and other conditions may result in marked and constitutional conditions and end in death, between the ages of 14 to 20, when family ties and social surroundings may make the case one of more or less public interest.

The second affection may result from pregnancy, miscarriage and death from loss of blood, or blood poison.

The third difficulty may be caused by fœtal mishaps, such as being overgrown and no timely surgical assistance, when death may result from exhaustion, and so again throw the neighborhood into a state of surprise and despair. *See page 88 and page 90.*

These cuts are taken from "Dr. Playfair's System of Midwifery," and I have a twofold purpose in doing so. The first is in that of describing a practical system of embalming such bodies, and the next is to make our embalming profession better acquainted with the truth of the important part our doctors are today enabled to play in saving the lives of so many, for I may say that the doctor does not loose but very few of these obstetrical cases when they are called in good time, because they have proven themselves equal to the emergency by supplying instru-

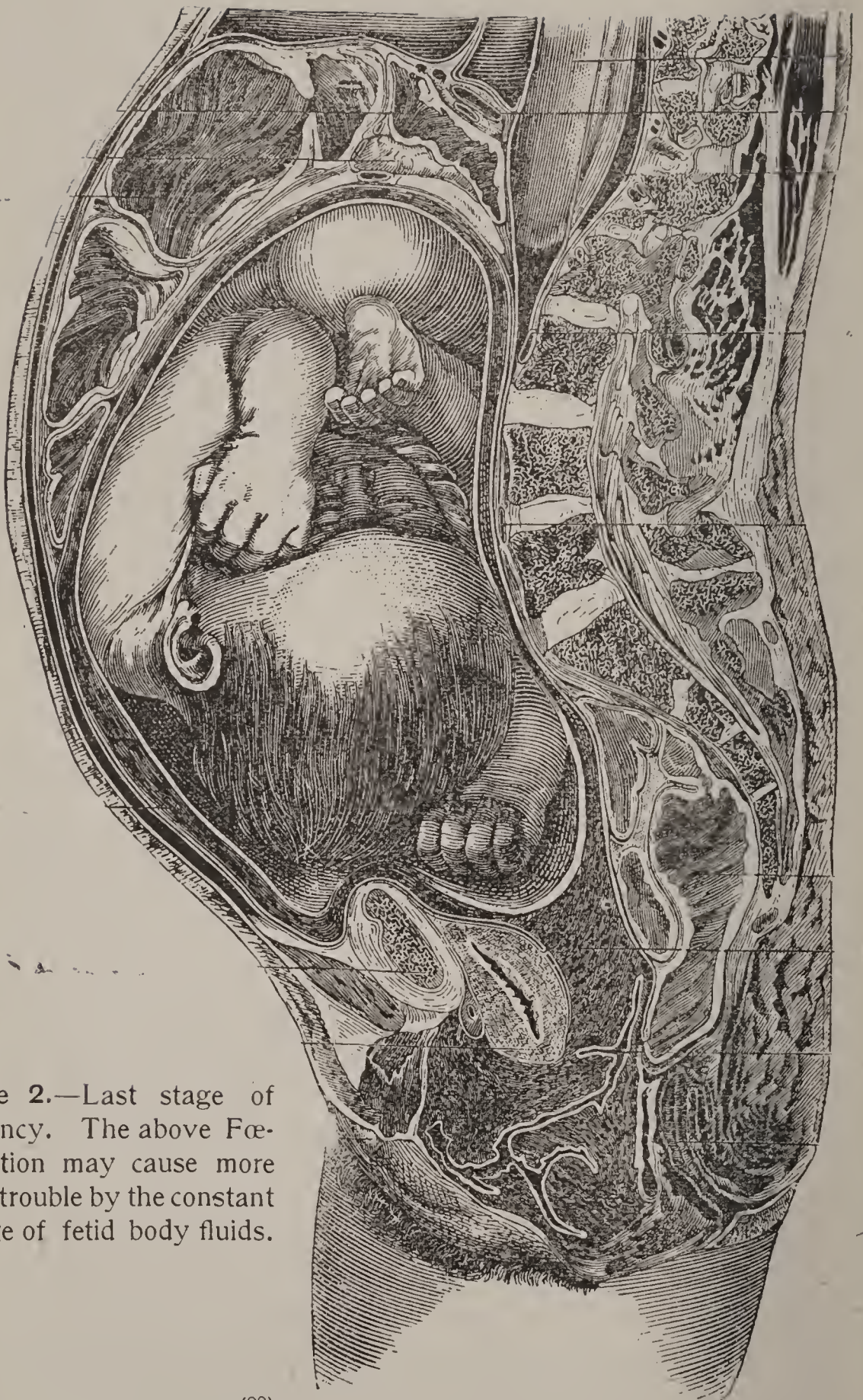


Plate 2.—Last stage of Pregnancy. The above Fœtal position may cause more or less trouble by the constant wastage of fetid body fluids.

mental and medical remedies for a comparatively safe delivery of all fœtal complications; and in speaking of complications, we may say that there are so many of these during the entire period of pregnancy, but those which are of the most concern to our profession is found in a possible **dropsical malady** or in that of some blighted ovum when a **fleshy degeneration** of the membrane takes place, or an apoplectic ovum becomes effused with a mass of blood—and so ends life by reason of blood poison or some complicated disorder.

Abortion may arise from some marked condition of the ovum, or from so many diseases like measles, scarlet fever, small-pox, pneumonia, fright, over-exertion and so many malarial causes that we cannot go into a full detail of them. But we will return and speak of plural births and say that sometimes two children may be presented simultaneously, and should the doctor not be at hand in time there may be what is called a head locking, which may end in death by exhaustion.

Monstrosities have many types which the doctors can, as a rule, take good care of the mother by performing crainotomy, but it is said that the greatest danger, both regarding the mother and child, is in cases called hydrocephalus, when the child's head has become enormously enlarged, caused by watery fluid within the cranium: but, fortunately, this disease is of rare occurrence.

There are many classes of hemorrhages, both before and after delivery, but their complexities are too numerous to be given in detail. Sometimes there is an accidental rupture of the uterus, or may be caused by the alteration in the tissues of the uterus by fatty degeneration during pregnancy.

History gives a curious operation as practiced by the Romans under a decree by Numa—that no pregnant woman should be buried until the fœtus had been removed by abdominal section. Tradition tells us that Julius Cæsar owed his life alone to this operation, and there are several well authenticated accounts of children whose lives were saved by this operation. And while we pen this item we speculate as to what the result may be by some embalmer's discovery and the saving of a life while professionally engaged in embalming the dead. However, the probability is that this operation can only be performed in the last stage of exhaustion of the mother, when the mother yields her life to save her child. This operation is called Cæsar section, and has been quite successfully performed many times and places during the last fifty years.

Puerperal State.

The puerperal state usually follows soon after delivery by a discharge of fluid which is more or less intensely fetid at times, or may take a fatty transformation form of the muscular fibre within the uterin vessels or in the placental site, or may cause a mucous change in the lining membranes of the uterus, and finally

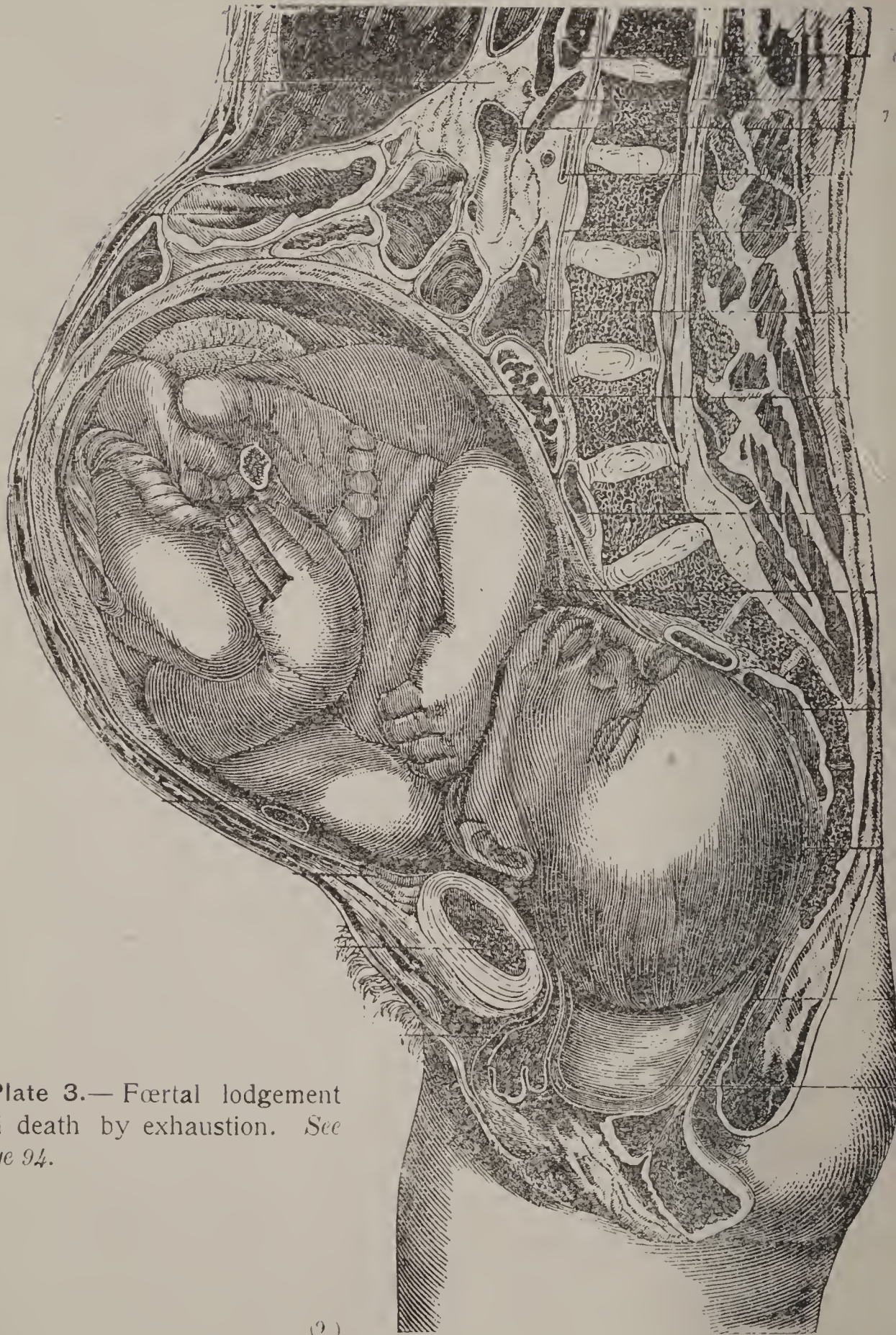


Plate 3.—Fœtal lodgement
and death by exhaustion. See
page 94.

end in death of the patient by some complicated disorder like blood poison and similar conditions.

Morbid Growths.

Tumors and Morbid Growths.—There are two, benign and malignant, which may be best classed as forms of structural degeneration, or vitiated nutrition, as cancers come under the last form. I can only give a brief outline of the pathology of **cancer**. This disease may attract all parts or organs of the body. Malignant growth is that class of disease which is prone to an unlimited increase, disastrous in effects and impossible to arrest or cure. Cancers are classed into three distinct kinds—**scurrilous**, or hard cancer; **colloid**, or gelatiniform; **encephaloid**, or brain like in appearance.

Scurrilous cancer is composed of a fibrous or filamentous tissue, with little fluid and fatty cells. **Colloid** cancer has a variable amount of fibrous tissue arrayed as a matrix. Described by some writer as being often like an orange, containing a jelly like substance with some cells, but not so frequent as in the first.

Encephaloid cancer is said to be the highest development of carcinomatous formation. It consists of a fibrous matrix containing an abundance of abnormal, multiform cells, and a peculiar fluid—the milky or creamy fluid as called cancer juice.

Cancers destroy life by exhausting the vitalizing process of nutrition, while anxiety, pain and sleepless nights hasten the work from a few months to a year or two. *See Fig. 38, page 95.*

Ovarian Diseases.

The ovaries are organs which, as Dr. Howe says, have an exalted endowment, yet are subject to various diseases.

Abscess of the Ovary is likely to prove fatal unless the purulent naseous pus can be directed through a safe outlet after suppuration is established.

Cancer of the Ovary is sure to result fatally.

Fibrous enlargement of the ovary cannot be removed with any practical safety.

Cystic disease of the ovary is very common, and by good management may be removed by surgical treatment, and according to Dr. Howe, Dr. Ephraim McDowell was the father of this science, closely followed by Dr. Burnham, Dr. Dunlap, of this city, and other celebrated surgeons like Drs. Russell and Austin, who have recently removed ovarian cyst, which proved this science of ovariotomy a complete success.

An ovarian cyst may consist of a single sac, and its contents mulocular, or embrace several sacs, each with different contents. These tumors sometimes grow so great that their weight will equal one-third the weight of the possessor, and destroy their life in the course of two or three years. We are told that it is not

uncommon to draw off six or eight gallons of fluid and then leave a gallon or two in the collapsed sac. Some patients have survived tapping a great many times. Women of all ages may be afflicted.

Putrefactive Substances.

Excessive adipose require various incisions in order to draw the water and the oily liquid away, otherwise this liquid may sour in an hour or so and by this means thicken and greatly engorge the body figure to that extent that the whole body may also become involved in the advanced state of putrescion.

Tumors are abnormal growths which may be full of body liquid infiltration and this may be a mixture of albumeniod and water or it may possibly be pure albumen or some fatty oils of a sacchrine nature and the rule is that all such body and cavity fluids should be removed as far as possible.

When the tumor is shown to be composed of some solid flesh growth or a fatty false tissue, which is dry, then there may not be any actual necessity for its removal, but the trocar should be used to explore the tumor so as to determine the truth of what the contents really are for sometimes the encystment may be so thick and terse that the operator might be deceived into believing that the tumor is comprised only of solid material when the worst mass of semi-purulent liquor would be found by the trocar or knife operation.

It has frequently been asked to explain where the fluid contents of tumors came from; what part of the circulation supplied such growth.

Various encystments like tumors always have a pedicle or root. Some of these are grown to fairly correspond to the size of the tumor, while in other cases there seems to be scarcely no pedicle. However, the various false tumor growths are each related to some special class, much in accordance to the cause which produces them. The rule is that some abnormal reason is assigned to the most of these false growths, though many of these abnormal reasons are assigned to injury, while with others, some false secretion, may have come possibly from injury, strains, or that of nature deviations and causes, and so not only tumors may follow, but such diseases as may be denoted as kidney, liver and other abnormal diseased affection, and so it becomes quite impossible for me to show just how it is that tumors actually get their fluid contents from, more than that it is by the many small absorbing vessel which supply the pedicle or root.

As each muscle and each cavity wall throughout the

whole body is supplied by some oily, albuminous or serous mucus fluid which supplies their surface. So, also the various encystment and tumor substances are also supplied and this more or less to the injury of other parts of the system and possibly to the ultimate destruction of life like those generally called ovarian tumor-cancer. While with that of the excessive growth of adipose, there is some primary cause which deposits fat in some persons while with others they can not store enough fat so as to maintain good health.

Then, as the tumors and so many diseases are shown to produce abnormal growth through some false minute vessels: while in other cases the lymphatic and blood vessel capillaries, there may be some direct cause for great and excessive deposits known as tumor. Yet, if we were to depend upon the completion of these blood vessels being a channel by which the embalming fluid would be conducted into these parts. I will say that while there may be a possibility that some embalming fluid might reach various false structures, yet the rule is that neither tumor, encystments or foetal substance can be injected by the arterial system as will be necessary for embalming such local putridious substance.

Dr. Playfair speaks of several classes of abnormal pregnancy, like tubal pregnancy or false ovarian pregnancy, and several classes of malformation, which are too lengthy for me to describe, further than to say that foetal deaths are not unfrequent and highly dangerous, because of blood poison and the destruction of the adjacent organs by ulceration. *See page 88.*

Physicians are usually ready to make very thorough investigations by post-mortem inspection, and when embalmers are professionally baffled by reason of natural and physical hindrances, we ought to be permitted by law and custom to make such exploring operations as the case requires, and in fact we should



Fig. 35.—Primary Incision in Abdominal Walls.

be justified in the use of the embalmers instruments whenever our judgment as professional men show a proper reason for such treatment. Fig. 35 shows the preliminary arrangement of the body and that an incision has been made in the abdominal wall from a point just below the umbilicus along the median line, the knife dividing the skin; fat and facia, but the tendonous walls have not been opened only, when great care should be taken to determine whether the fœtus is alive. In cases of pregnancy this operation would be called Cæsar section. *See page 89,* and proceed accordingly, though it would be far better to call the family physician should there be any grounds for believing that such was at least probable. All this would be shown by lack of proper attendance, warmth of the body and short elapse of time after death.

In case of dropsy, tumor or inflammation of the bowels, or any disease which engorges the abdomen with putrescing fluids, the knife should not be used until the aspirator had been used, or what is better, a $\frac{3}{4}$ in. pipe with the same size of rubber tubing, and then several gallons of this fluid might be found in some of the largest cases of dropsy or ovarian tumors.



Fig. 36.—Ligating the Pedal of an Ovarian Tumor Before Cutting Away.

When embalming the bodies that have tumors for any definite length of time, it will always be found expedient to remove the tumor growths especially, when they are large, because these are likely to be made up of several cysts, and each of these sacs may contain a somewhat different fluid or pus, and as no operator can remove all this souring product, the knife will give the best security against such difficulty as great fetor and possibly the loss and control of the body from rapid dissolution. *See Fig. 37.*

In Fig. 38 we are shown a cancer of the breast which the sur-



Fig. 37.—Abdominal Wound Closed After Operating for the Removal of an Abnormal Engorgement.

geon has operated upon, but was unable to cure this rapid growing disease, and there are many times when the embalmer will find trouble from the pungent odors, and it will be necessary to introduce the trocar into any swollen parts and so route the purulent fluids and gases before injecting the local parts, while other treatment should follow as the case may require.



Fig. 38.—Cancer of the Right Mammary Gland.

Specific Observation of Putrification and Its Causes.

The embalmer's observation should become careful to the extent of a methodical refinement in all that may be shown by physical signs and the prospective changes from day to day. For very much may be learned by experience as various opportunities show something to define a proper system by which one case may, in a measure, be shown as similar to that of others. Yet, if we were to make all our diagnosis upon any case simply because it was the same age or the same size, or disease, we would then soon learn that there was a demand for some better system by which to class these subjects, so that each one could be so fully understood as to enable the operator to foresee the probable and possible results each body would give at the end of a given time.

While primary attacks of disease may be of little consequence to the embalmers, yet a postmortem examination would reveal many morbid stages, which not only vary according to the pathological, but the physical condition of each case.

This being true with what physicians show us concerning the destroying results of so many diseases, and so may be shown of the greatest consequence, that the embalmer must know the possible and probable internal obstruction, and such other physical derangements that various specific diseases may cause for the embalmer to overcome when undertaking to embalm such bodies.

Intelligent experience of the past has created many demands for remedies to meet the actual necessities as required by a long line of disastrous influences, so many of which are yet very far from being fully understood by many of those best posted on methods and processes of the art.

The problem which a subject may present is not that the deceased is large or small, young or old, but there are so many things which could be more intelligently discussed by methods if we had them of a fixed class or rule. As we have none, we must look for a physical sign of our own rating, and this should not be by the single physical condition, but by the combination of morbid and physical conditions in order for us to better observe their resultant tendencies.

It can only be by the thoughtful and observing study of both disease and physical relation, as they are variously combined and so make a stage of putrescence and decay, which can ever give us as professional men the key by which to solve the mysterious probability and future possibility of so many subjects which the

embalmer is professionally called on to answer for ; and now as this is true, we want more different rules by which to better determine and measure the problem of how long the body may be kept free from all obnoxious condition, and this to be determined in a fairly reliable measure by what we may see, or reason out as being the truth of the case, from what may be learned from the present and past by a close observation of the things and circumstances which surround each case. A thorough knowledge of death causes will include a wide acquaintance with diseases, and when we combine with this knowledge a few pertinent and relative questions, we may feel quite sure of deriving at the truth of the internal physical condition of each subject which we may be called to embalm—and so by this, a special study and a close observation gives us the knowledge which is the only key to begin this scientific professional work.

In was early in 1873 or '74 when I discovered that the flesh of a child was soft and fluid in proportion to a given quantity, and that disease might or might not take away a great part of this fluid or flesh, singly or together. Not long after this I found that all classes, both young and old, were also constituted at a wide variance of flesh texture, as well as in the body fluids.

I soon found that to know nothing of the diseases which caused death would only result in a failure of not less than 78 per cent. of my work as an embalmer, and I also found that twelve per cent., on account of body emaciation and favorable surroundings, would keep well on a cooling board and did not require embalming. Three per cent. might require the knife or trocar, while this and the seven per cent., "balance of 100 cases," required cavity embalming with chloride sodium, to saturation, of about 40 oz. aqua pura, and in a few of the extreme cases it was necessary to add an ounce or so of bicard sodiæ, and about the same amount of potassium caustic in other cases. In fact, there was about 22 per cent. of easy cases as against 78 of very bad and difficult cases to embalm and keep, counting the time of keeping not over four days and four per cent. deduction for every day thereafter by cadeavic softening and body worms.

On inspection it will be a good rule to make a close and careful note of everything we may be able to learn by inquiry, and a few pertinent questions, when understood, will go a long way to give us the key to so many cases.

What was the **actual causes of death**, is often a query to some of our best doctors because of the many complications of diseases or the inability of those around the patient to explain all.

However, a word may give us some knowledge that when shown by the side of some engorgement of the thorax or the abdomen, may then enable us to better determine upon the consequent internal condition of which some special operation will then be seen as necessary. Many physical signs may be enumerated after death, when once we study and learn them by a thorough

knowledge of diseases and their attacks upon the various organs of the body, leaving thereby various consecutive stages and possible disastrous results for the embalmer to remedy by his one, or possibly two processes, and the result is that about all cases that may be retained for more than ten days is not wholly as satisfactory as the more intelligent of our profession desire to see as the result of their embalment.

All necrobiotic signs are far from being understood as they ought to be. The writer insists that deceased human flesh texture may and now ought to be classed by a far greater variety of class structure, as shown in various cases, than has yet been considered by any special writer upon the subject of either the chemistry of the human body or its embalment.

Next, the fluid condition of the deceased body is a matter of the greatest consequence to the embalming operation.

As fluid constituents of the body belongs to the special science of analytical chemistry, so will be the corrective methods of assimilating drugs and chemical reagents or processes by which to embalm and keep them, because, as Dr. G. G. Groff says in *Annals of Hygiene*, March, 1893 :

“Bacteria belongs to the most widespread of organisms: we may say they are omnipresent; they never fail either in air or water; they attach themselves to the surface of all firm bodies, but develop in masses only where decomposition, corruption, fermentation or putrefaction is present. If we place a piece of flesh, a pea, or other animal or vegetable material in water, it will become, earlier or later, thick and then milky. It loses its transparency, because the bacteria completely fill the water; at the same time the putrefaction increases, under the development of different, and for the most part, bad-smelling chemical combinations. After a time the thickness disappears, and the water becomes clear and odorless, the organic material is consumed by the bacteria; these now cease to divide themselves further, and heap themselves on the bottom as white sediment, without motion. If a new supply of nutritive material be added to the fluid, putrefaction and the multiplication of bacteria, which are not dead, but in a state of temporary repose, are seen to begin anew.”

As we look into science and trace this for true facts, we may see the truth, as it so often exists in many of the simplest things, and the embalmer will do well to look into the subject of bacteriology, as there is now no question of the importance on their own account for them to learn to know the classes and varieties of these micro germs as no doubt that when we know them as they exist. Invisible, yet possessing irresistible power to especially govern the process of all forms of dissolution from the simplest classes of drying decay to that of causing a sporific and rabid and nasceous putrilescination, and this under circumstances of the greatest importance, and today require methods for supplanting these destroying ravages, so far as pertains to embalment by some proper remedy to either prevent or destroy them.

We are told that nearly all bacteria possess two different modes of life, one of motion and another of rest. In certain conditions they are excessively mobile—sachrine and albuminous matter and water, under favorable temperature and oxygen, provide nourishment, and they take on various forms as they swarm in myriads of animation, each class peculiar to its own specific origin.

The great question with the embalmer is, What are the classes of putrescences, which they, as specialists, must provide remedies and reagents to destroy? Are there but one class of these micro germs, or are there as many varieties of these as there are of the different substances of fluid and matter which make up the various proportions of the physical condition of a deceased body.

Lactic acidity is a form of fermented animalculæ, as it may be traced from milk or sweetened water. We are also told that albumin, gelatine, also, may become impregnated with specific germs, and that certain fatty oils putrinate and form futric acid; and so as we can trace several classes as they emanate under certain conditions, why cannot someone reduce this theory into more definite classes of putrescence?

Dr. Groff and others tell us that the forms of bacteria of some classes resemble balls or eggs, in others short or long rods or fibres; sometimes they look like cork-screws or screws. Many of their bodies look as though they consisted of almost colorless substances like albumin—others exist in a similar substance, in which numerous shiny, fatty granules are imbedded and which is inclosed in a thin membrane (cellulose). Substance that is said to be insoluble in caustic potash. While the above article is in press, the January, '95, number of *The Casket* comes, and after reading every line of Prof. Hohenschuh's grand and scholarly lecture to the recent assemblage of the National Funeral Directors Convention at St. Louis, Mo., I find that the professor does not fully corroborate Dr. Goff's statement regarding the chemical destruction of some special classes of micro organism, which are so variously due to the process of the putrifaction of animal substances, and I must say that perhaps nothing would provide such a lesson for the advancement of our special science as would certainly be given were the professor to lock horns with the doctor, who, I understand, is considered good authority on the question of sanitary bacteriology, and what the professor would be able to say in the defense of our present modes and customs of embalming might be rated very high, as may be seen in his published article, though, as for myself, I am willing to wage that the professor while specifically right, yet it is scarcely possible for but few of our profession to be able to fully manage the more dangerous classes of infectious diseases better than by the careful observances of all those rules laid down by the sanitary boards, to which our present embalming treatment will then become what might be styled as a double security against such zymotic and other dangers.

The Microscope.

Carpenter also tells us that according to their form, we may, by the aid of the microscope, distinguish ball, rod, fibre and screw bacteria, but unfortunately the scientists and microscopist have failed to define these various germs, as they may or may not exist within any particular substance, or the question for us now to settle is, Are all classes of bacteria liable to collectively or singly impregnate all classes of putrescinating substances?

If this is the case, then is the embalmer to simply treat each case for "germs," without any relation to their class? Otherwise, specific physical condition may involve a specific bacillus, which may be considered and treated more practically, as these conditions may show as related one to the other.

In reviewing this matter from the author's own experience of some fifteen years or more past, his simple plan was to first determine the actual condition of the body and causes of death first, for by this knowledge he was usually enabled to locate special disorders of the viscera, or the organs of circulation.

Then following this came a study of the physical signs by noting the actual condition of the body fluids, whether the blood fluids were to be found in the veins, or were held back in the capillary and flesh cells by clots or cavity gases, locate swollen, thickening viscera, observe whether the body fluids are excessive or emaciated, putrid or not. If the lymphatic system and fatty substances are full, dry and solid, or damp and soft, watery, dark or clear color. Note the flesh condition, whether soft and fine texture, or muscular and strong open-grained texture. Observe whether the arteries and veins are large or small, strong or diseased, dry or watery.

Determine the relative proportion of both flesh and blood fluids.

Emaciated, normal, large, or an abnormal physique.

If dry, damp, spongy, soft, greasy, glossy, or stranded surface.

Note the color of the flesh, whether palid, yellow, purple, blue, brown, livid, black, or red; general or local blotches.

Note the color of the veinous blood fluids, whether light, yellowish, purple, or black red. The first may be watery and albuminous; the second may comprise the two first and eczesis, of small portions of fibrine. The third may be largely due to the albumin oils and amonical condition; while the fourth color may be created by the albuminous and congested state of the fatty and sugar substances, as they take on the second stage of fermentation. A congested fibrine will not flush the face by pressure, and the black, or lactic acidity of rich albumin and sacrine substance that are also rich with oily substances will impregnate the whole system very rapidly, as they apparently go from the white and placid flesh, to that of a black and ghastly one.

We may take two infants of equal age and bodily proportions, yet the physical condition may vary greatly in the two, each soft

and delicate flesh, though, when examined closely, one will possess open porous or firm granular flesh texture, while the other may be comprised of flesh substance, extremely soft and tender, and knit together so closely and delicately with full rounded flesh cells, which all but chafe under the slightest friction.

With the slightest thickening of this tender flesh, it will fall to pieces, because of the flesh texture, while the first one has a flesh more susceptible to the expansive forces of the fermenting gases.

With all infants this composition is such as to comprise a large per cent. of sweet serous matter. The presence of lymph or water always hastens the lactic fermenting acidity of both flesh cells and fluids of the body.

There will be at least five general conditions attained by chemical reagents, either of which must be made variable by the drug compounds according to the physical requirements of each subject to be embalmed.

A seroid or granulated condition of the sachine matter, according to that class of subject.

Next, a saponified condition of the fatty, oil substances in the second class, and a very dense coagulation of the albuminoid fluids of the third class. A drug which comprises a proper chemical affinity of emaciation will take away much of the water from the gelatin substances, of the fourth class.

Both the acidity or alkaline bases must be rendered neutral in order to prevent new formation of micro organs, with deceased bodies of the fifth class.

Example.—Two children exactly alike in the physical make-up, one killed by accident, the other dies by an attack of disease.

The first has all the sepsis fluid and flesh cell substances to be contended with, while the last by reason of the ravages of the disease may not possess but little of this infusion matter. Possibly much of the lymphatic fluid and water may have been exhausted, and now by the same ration of their presence, or non-presence, we may measure the probability and future result of the deceased child by reason of disease as against that one which was killed. However, we must not lose sight of either of the two classes which are shown, for each one may be variously re-classed in the five general stages, and it is true that to each of these five of the general stages we will find varying, according to the disease, and the various resulting morbid conditions, as these are combined with the bodily or physical condition of each subject.

While with many, there will be **plethoric**, the blood thick and composed of red corpuscles of blood fibrine, sachine and albuminic fluid substances. When in this condition, the body figure will be full and round, and often the blood vessels will be very dark and possibly gorged. Yet when the body heat passes away, the distended blood vessels will settle as their contents become settled into the trunk of the body; but what is of the greatest consequence now will be found in the fact that this body heat will linger in some cases for many hours, and this heat assists

the culture of lactic acid within the body fluids, or if the heat passes off a similar heat may follow.

Anœmia is the common term indicating the poverty of the blood corpusels, and it will be understood as the opposite of plethonia. Yet it does not follow that the body will be emaciated, for while this blood poverty always leads to a poverty of the lymphatic glands and fatty substances of the body, there may be many causes of death which may be such that the body will be full of watery fluids, which are also subject to lactic fermentation. The plethoric case becomes black from excessive fibrous echmysis, followed by a rapid enlargement of the body, while some of the anœmia cases may soon go to pieces without darkening the face very badly. Yet **uræmia** albuminoria are each maladies which ought to be separately considered, for the composition of serum, blood, mucus, lymph and all abnormal conditions should be made a thorough study before any one can hope to become able to diagnose a case unless it be some case specially mimified by the disease, and one that is so dried up that there is but little flesh and blood left for the embalmer to work upon, and the time has now come when all this class of subjects are too tame for an embalming student of today, to mention them.

When we are called to inspect the body we must be able to discriminate between "flesh texture condition," as well as in the "fluid components," and we must determine upon various **methods of instrumental operation**, for where we see full rounded bodies softening and becoming cadavic and nasceous, more will depend upon the methods of operation than has formerly been supposed (*See chapter on diseases*), because if we are able to locate the seat of difficulty and treat this properly, all trouble may be obviated when the most thorough embalment may be done, but if by one oversight this in one organ or cavity should be overlooked, the case may be lost for the want of special instrumental treatment in order to remove that difficulty, and so then we see why local treatment should become specific to the extent of specific causes, such as abscesses, engorgements, aneurisms, ruptures and a long list of diseases of the various organs of the body which include so many abnormal and physical conditions of the body that specific treatment is justified in the various requirements of the embalmer's art.

About the time, or soon after the centennial year, 1876, the writer published through the columns of *The Casket*, saying that there was more trouble involved in embalming the body of a person killed by accident than one of similar physique dying from the ordinary attack of disease. As I am still of this opinion, I will state why; and to be plain, we may say it is because of the richness of the body fluids in sacchrine matter it contained; it is also largely composed of albumin; third, both the fluids and soft flesh cells are made up of rich oil globules. The first sours and gelatine may form lactic acid and so foster the agents of putrifaction and so spontaneously combine to form amonical fetor.

There are several other classes of substances of both the blood and flesh cells and there are also several more possible and probable condition of the organs of digestion that may become the propagating medium for microbes of putridity.

Then closely by side of this last comes the mesenteric system, also full of special substances, and side by side of the last two we find "three separate classes of digestive ferments." All of which enter into rapid and expansive energy in the work of destroying much of the substances which surround them after death.

Prompt measures of embalming reagents may correct this **abdominal putrescence** and the same may be done throughout the larger arteries, but scarcely further than this.

My theory of this is first because of the sacchrine substances being found present everywhere throughout the body and flesh cells; the sweet fluids sour and break down the oily globules, when the albumin thickens as it combines with water, until great volumes of hydrogen gases expand each globule and each first cell, while a gelatin substance forms, thickens at first, and then in a few hours all of the body becomes so involved into ammonial fluid and gases, virtually leaves no fleshy substance or the possibility of a chemical reagent that is known of as being strong enough to stop this, nature's work of destruction, unless, as we said above, that there be prompt and intelligent measures of embalmment, and this under certain fixed conditions of which the subjects, physical conditions, may possibly give, in the first requirement, if this class be embalmed at all, it will be found in a fairly large and porous flesh texture, as well as with large arteries. Small arteries, a fine flesh cell texture, and deep fleshy condition are physical conditions which, if kept at all, will require the very highest skill of embalming art.

A Pocket Lens.

In my own practice, I began to carry a pocket lens, or microscope, during the fall of 1874, as I had observed some bodies of both young and old men, of various physical strength, go into the most rapid stages of decomposition after being killed by accident while working in the timber, or on the railroad, or in the employ of a charcoal iron furnace. The truth was that no embalming fluid which was then on the market at that time would keep these bodies, and I wanted to know why.

I began to study special books of chemistry and morbid pathology long before, and yet I was unable to make any practical use of the pocket lense, or the process of injecting the arteries by Dr. Wm. Hunter, or the old Austrian surgeons process formulas. In fact, I found the whole book, and embalming formulas of M. Gannal, and of Tranchina, of but little use to me when it came to embalming and keeping some of these bodies as I thought they ought to be kept, as I rated them by comparing them to other similar cases which I had embalmed and kept, and, as I then supposed, in the most approved way. Study and close

observation showed me that some bodies required but little attention, while others would require the most careful and scientific embalment, and then some of these would fall to pieces after a month or so. Some time during 1876 or '77, I was called on to superintend the taking up and reshipping of the body of a lady which I had embalmed and buried in a plain coffin four months previously, and this instance gave me an important insight in the true methods for inspecting the bodies after embalming them, and it was then when I began to clearly see that embalming was a progressive science, for while a given formula and a given process would do for say fifty or sixty per cent. of cases, this would not do for all cases, because of both physical and pathological hindrances. The sexton that had charge of the men employed to open the grave and take the coffin out, had provided a pole and a hook which was used to remove the first board and break the glass. June, July, August and September were all hot months, and so I was prepared for an imonical gases, which, after showering the box with disinfectants, passed away in a few minutes. After the body was raised and saturated with my disinfectant, it was taken to my place of business and carefully examined. Some small portions were examined daily for some weeks, and side by side of this I took up the study of special bacteriology and followed this soon afterwards into the special study of microscopy, for I had discovered that a specific physical condition would always be followed by certain classes of micro organisms, due to specific causes; however, while prosecuting this study, I found that Hunter, Liebig and M. Pasteur had each shown this and that it was already a well-known and established science. Yet I got a new theory for providing ways and means of embalment under fixed rules of my own observation. My friend, Mr. Mark Remington, agent of the West Michigan R'y, took charge of the body spoken of and shipped it through Chicago to some place in the North-West and this in a new pine box and in the same wood coffin that was taken from the grave.

After a few trips to Chicago, Detroit, Grand Rapids, and other cities, I determined to reduce my idea, if possible, to a practical method for classifying certain forms of body decay, and if possible arrive at better methods for treating and embalming them all. As a triple pocket lens has greatly assisted me, I would say to others to try it, and especially try to determine upon some way by which to enable yourselves and other students of the profession to know a specially dangerous body physique as soon as they see them, then all will agree with me that specific operations are no less important than the drug we profess to know and use. If each of our practicing embalmers will begin all their observations by a simple class rating of each, it will not be long until some new and surprising discoveries will be made for themselves, and some of these no doubt may probably prove of the most practical value to all who study for the professional advancement of all who are honorably engaged in the work.

Diseases and Their Relation to Putrescien and Body Dissolution.

Morbid stages which interrupt the normal functions of the body is called disease. When these disturbing influences, either from injury or some morbid causes, may so far deviate from the normal function of life to that extent which by many ways destroys respiration and the heart's action—this is called death. After this the body juices cease their chemical activity in their work of generating electricity, heat and magnetism. Then it is that various species of animal and vegetable growth are produced and may be classed as bacilli according to that of various kinds that are known to each class of substance matter to which each species belong, when this stage is called putridity. To go still further, we may by the use of the microscope trace many of these animalcutions by their well-known fungi cellular growth according to form, class and species, from production to that of what the microscopist says are reproduction of other species of bacilli until all former substances of the deceased body are lost by many of natures forms of decay and dissolution.

General pathology may be in error with the true class and stages of some disease, but there are now very few maladies which are not fully known and described by the many acknowledged authorities on the history and treatment of all classes of disease. What is of interest to the embalming student, is to know that many pathologists have become so expert with the microscope that they can trace many of these diseases far beyond the morbid stages of life. As bacteriologists, they may follow the marks of morbation or necrobiosis to that of putrescation and so give us the true and specific history of each phenomina of nature's laws and process, which take all such body substances back to the elements, which are said to surround the universe.

As methods of study and experiment have been necessary to follow and battle with the scoriging ravages of disease, and so much has been done and so shown and acknowledged with its many grand benefits for suffering humanity, why should not the modern embalmer, as a

specialist and professional man, take up that science which is shown to belong to what are nothing less than stepping blocks for the higher necrobiotic sciences as it relates to the dead? In this manner study methods as well as processes, and so strive to make a more scientific and exact observation of what relates to a better and more successful way for embalming those deceased bodies which the public place under their care for treatment, inasmuch as they now profess to do that work.

Now to do so means something, or are we to consider it unimportant. No professional knowledge or culture can be attained as it should be done, except that which is accomplished by a vast amount of hard study.

Possibly there may be some few exceptions, but those who will take up the sciences relating to embalming and studiously apply their minds to those studies, will no doubt see the time in the near future when they will be received and respected as men of an honorable station in life's calling. While embalming is not any part of modern religion as with the Egyptians, it has a much higher place, as a safeguard in the proper sanitation as well as for the many benefits in retaining the dead for shipment or in reuniting absent relatives and friends. In this manner this new custom strengthens the bonds of humanity and Christian principles. Thus it is that modern embalming has become no idle falacy, nor an experiment of the curiously inclined, but it has become a proper requirement as grown from recent safe and considerate methods in the higher achievements of the human affairs of every day life. A new vocation has arisen which can only be supplied by the intelligent and energetic students who will faithfully prepare themselves for doing the work in as trustworthy manner as could be expected from men of this or any other profession.

Death, as Caused by Diseases of the Lungs.

The principal affections of the lungs which are more or less liable to cause death are given by the pathologist in five distinct classes. Each of these are known by their specific symptoms as are shown to result from the morbid attack upon certain parts of the body and so create a local or general disturbance of the normal functions of life. As these various disturbances by this manner of destroying life may destroy or otherwise derange the internal organs of the body, the embalmer must know the precise extent of such local or general derangements, before any intelligent and successful embalming can be made, by any method for practical and theoretical embalment.

Lung diseases have many uncertain complications

which may be caused by various diseased attacks upon other organs of the body. The principal diseases of the lungs are *Pneumonia*, *Pleurisy*, *Emphysema*, *Asthma* and two forms of *Consumption*. Space prevents giving any lengthy description of these diseases or the definitions of the many medical words. *See dictionary*.

Under this head the embalmer will learn the primary causes of death, and as there are several well defined varieties or classes of disease of the lungs, it will be well for them to study each class in order to learn what may be the actual condition of the lungs or what other organs of the body may be diseased also, by reason of some complication.

PNEUMONIA.—Caused from cold and-wet, from injury or typhoid fever.

Its progress is rapid. In pneumonia the breath becomes purulent; the lower or middle lobes become congested or engorged, followed by softening, or purulent infiltration. *See fig. 29*.

Death rarely occurs before the sixth day by asphyxia and later by exhaustion. Sometimes an abscess forms gangrene of the lungs.

The worst form of this disease is said to be when complicated with other diseases—like typhoid fever.

PLEURISY.—Inflammation of the pleura (lining membrane) which encloses the lungs and reflects upon the inner surface of the thorax. *See fig. 29*. Transverse section of the thorax.

This disease takes place generally after a chill or cold stage. The disease usually centers in the lower axillary region collecting into serous fluid or pus from an abscess which ruptures the lung. Sometimes the fluid may displace the heart, lungs and liver, and bulge the ribs and soft places. Physicians have frequently used the aspirating needle to draw this fluid out of the chest.

The embalmer will observe that when the face of the dead blackens or becomes livid with blotches, it is usually because some abscess of the lung, pulmonary gangrene, or emphysema of the lung, and the trocar should always be used in drawing out this fluid. In fact, I always feel justified in using the knife when there is any great engorgement of the chest, especially so when the trocar fails to draw off this pus fluid, and then by injecting the embalming fluid into the cavity around the lungs and heart, and also by injecting the same fluid into the lungs and arteries we may stop the thickening of the flesh of these organs of the chest, and so destroy all fetid gases and by this means secure a good appearance of the face. *Fig. 27*.

While arterial embalment may accomplish this re-

sult by use of a good fluid, yet, when we consider the unreliability of some fluids and this coupled with the engorgement of the chest, as a rule in both children and adults, we will recommend that every precaution be observed by the most thorough use of the trocar in order to locate and remove the obnoxious pus fluids should there be any. See Balls' lecture.

EMPHYSEMA.—This is the dilation of the pulmonary air-cell of both lungs. It causes bulging of the chest and sometimes the displacement of the heart and liver.

The word Emphysema means (I inflate) and it may be caused by injuries of the larynx, trachea, or lungs, fractures of the ribs or wounds penetrating the chest. There are four classes—accidental, or symptomatic, the spontaneous and idiopathic. Known and classed by the cause and manner of affecting certain locations like the Pleura. The progress of this disease may be gradual in old persons, but is likely to prove more rapid in the younger classes, where abscesses and liquid infiltrations may be found in some of the complicated cases.

Collapse of the Lung.—In severe cases of whooping cough, bronchitis, especially in children, there may be considerable obstruction of the air cells which may lead to an exhaustion similar to pneumonia, and so is considered as always fatal to both children and aged persons, and the embalmer should use care according to the general rule of treating this as in all other lung troubles, because there is to be found a large quantity of blood fluids which are likely to be rich in the fats, oils and lymph fluids of the body and this is especially so with so many children of former robust temperaments. See *fig. 33*.

ASTHMA.—When complicated with an enlargement of the heart or some pulmonary trouble may give the embalmer no small amount of trouble in order to hold the body from going to peices in a very short time. This disease is said to be hereditary in most cases: but one thing is quite apparent and that is, so many corpulent persons are afflicted with it and we also see that the complication is like that of heart trouble and diseases which may result in death by apoplexy, and so we will cite the reader to the chapter upon that subject.

CONSUMPTION.—This is a disease which is mostly hereditary, though this disease may follow a severe attack of Acute Bronchitis. Most common within the ages of 18 to 35. Sometimes syphilitic disorder may show very similar to Consumption.

Great emaciation, chills and sweating of the feet are last condition, though patients sometimes live for years, though complicational diseases are frequent.

Death by Asthenia Exhaustion.

Galloping consumption, known as acute Phthisis, may end life in two or three months, it sometimes follows pneumonia. This disease differs from the ordinary stages of consumption chiefly in its rate of progress. Softening of the tubercle, and the formation of cavities do not always occur to any extent, apnoea being caused by extensive defusion, or infiltration of the tuberclosis deposite through the lungs, and death by suffocation may follow. First, from hemorrhage. Second, rupture of a large vomica, an encyrtia collection of purulent matter in the interior of a virus, breaking into the bronchial tube, caused by an abscess or softening of the tissue. Sometimes these bronchial abscesses may discharge into the cavity of the pleura, causing emhpyema, and death as the result of about all of the advanced stages of quick consumption. And for the embalmers to successfully handle many of these subjects will require a well studied method for treating each case, and this largely by what may be required by the physical condition of each one, for a plethoric, or sacchri-albumic child or adult, will be vastly different from that class of diseased bodies of pallor flesh and emaciated bodies, usually found in most of the lingering stages of consumption, when great emaciation takes away the body fluids. Cadavic softening usually follows in this class of bodies, and some considerable attention must be given them, if such bodies are to be embalmed and retained for more than the usual time. (See methods for Embalming.) Pathologists say that hereditary taints of consumption, syphilitic disorder, alcoholic and excessive abuses, lead to many complicational diseases, with both the chronic and acute forms of Phthisis.

Death by Diseases of the Organs or Circulation.

Diseases affecting the blood vessels, or the organs of circulation are known as : Pericarditis, Endrocarditis, Anurisms, Apoplexy.

PERICARDITIS.—Inflammation of the covering membrane of the heart. There are two varities known to the physician, simple and rheumatic pericorditis. See *fig. 29*. Stages: adhesive and effusion.

In this disease there is great danger of life with all classes of persons and usually terminates in a few days. Bright's disease of the kidney is occasionally associated with it. With all cases of internal disease the embalming surgeon must be governed by the physical body conditions which each one may present, for it is found that in most of the fatal cases there will be a

quantity of effused serum, varying in quantity from a few ounces to pints or possibly a greater quantity of it, and if so, it will weigh down the diaphragm and so be found in close proximity of the stomach, and in some cases there will be a purulent fetid gas which will become very obnoxious.

ENDROCARDITIS.—Inflammation of the lining membrane of the heart.

This disease, like that of pericarditis, has the same origin, valvular disorder, and enlargement of the heart, also fatty degeneration may be variously combined with kindred diseases and so the embalmer will hear many reports of heart disease.

While heart failure may be a common verdict of the physician for so many deaths, it is rarely that they are not able to give the true diagnostic causes of these two forms of heart trouble. Persons, stout, very large or corpulent are most commonly attacked by heart trouble and it also seems that it is just this class of persons who are more or less people of business or social prominence, and the writer will say that of all the many enquiries asked of him by so many embalmers all over the country this question of "how shall I treat and embalm" a body after death by heart trouble, or that of apoplexy is the most frequently asked. There are two reasons for each of these cases: one is because such bodies are hard to keep if not well and thoroughly treated by both instrumental and chemical measures, and also these persons are of a naturally prominent predisposition and so all eyes of the neighbors are turned to them while under the embalmers care, and so here centers more than a double interest for both the embalmers and his patrons and the friends of the deceased.

DEATH BY APOPLEXY.—We are told that there are four general forms of diseases which result in violent or sudden modes of death called apoplexy.

Good authority sustains the theory of but two forms of death which may be caused by **congested state of the blood**, or that of a **hemorrhagic character**. Yet there seems to be a strongly laid claim for two more forms of attack. These are classed as **serous Apoplexy** and **nervous Apoplexy**. While it is not possible for me to enter into a full detail of all these separate diseased character, I desire to show the modern embalmers enough of the important features so that they can readily understand that valvular diseases of the heart, fatty degeneration of the heart or the arteries, rheumatism or some pulmonary affection, or some possible debility of the muscular walls of the heart or arteries may cause sudden or unexpected death. and under this

head we might add still other modes of death as may be caused by an aneurism of the Thorax, or abdominal arteries. But as each of these modes of attacks are encumbered with so many intricate casualties, I will only note a few of the principle causes of **Apoplexy**. With the congestive **Apoplexy** death is directly caused by blood clot or a pressure upon the brain and the next is by hemorrhages.

Death by Hemorrhages.

This may be caused by wounds or when under the surgeon's operations. Sometimes by typhoid, yellow or remitting fever, all of which are termed critical.

PULMONARY APOPLEXY.—The heart and several other organs may be variously affected by hemorrhage followed by death in many ways.

Hemorrhagic Apoplexy.—Death is the result of a rupture of a fatty degenerated artery, or the heart may burst open, or an aneurism may form a false sac or tumor of some artery or vein, and finally destroy life by Apoplexy or heart trouble. My observation has been that persons subject to this class of disease are of large physical frame, large heart and large arteries, and in fact so many persons of public prominence, are liable to some mode of sudden death by Apoplexy or heart trouble. Of all adult maladies, this class seems to be the most common. While Dropsy, Hasty Consumption, death by accident, inflammation of the bowels and pulmonary trouble are diseases which destroy life by so many complicated ways that the embalmer will so often feel puzzled to know just what the result of his work will be, as there will be so many things which he cannot quite understand, and therefore all should be careful in laying any great claim upon the result of any specific operation or method of operation until all possibility of failure may pass and show as time elapses, that the embalming reagents are doing good work. In all cases of sudden death it will be found that such bodies present the full amount of blood and flesh juices they contain, in a way and under conditions which become the most perplexing for the embalmers to dispose of, and the more we know of the true chemistry of the human body and the anatomical structure, of the organ which circulates these fluids of the body, and go to make up the flesh, oils, fats and the Lymphatic system, the better they will understand how to either remove these fluids or stop the souring and the breaking down process of the flesh and fat cells of tissue as the rapid process of fermentation takes place. *See chapter*—“**Spontaneous Dissolution of the Human Body**”—written some fifteen years ago.

In order to show the primary causes which make Apoplectic and similar cases so much worse than similar bodies of similar weight and appearance, I will say the actual condition of the blood, or rather the juices of the flesh are such as will foster the putrescing condition at once. These fluids are sweet, oily and albumic. See page 32.

Death by Diseases Affecting the Organs of Digestion.

Perhaps there is but few maladies which are more dangerous to children than those diseases which affect the organs of digestion, and are known as inflammation of the stomach and bowels, peritonitis, and complication with malarial, typhoid and other fevers. Various stages of bodily emaciation may be met with by the embalmer in cases of some lingering fevers, but the diseases spoken of as inflammations, death may occur before the process of the disease removes any amount of the body or flesh juices. So various stages of rabid, or sporific putrescations may follow death very soon after the patient dies.

Inflammatory diseases in the mouth may lead to serious difficulties, especially with children.

Fever and constitutional conditions may lead to extreme inflammations like gangreen, ulceration and mortification may go on rapidly and lead to death, and with this line of diseases we may see chronic gastritis or chronic inflammation, ulcerations of the stomach most often met with in feeble women in middle life.

Cancer of the stomach which seldom occurs before the age of forty or when the duration of life of a child is about one year, seldom two years old.

PERITONITIS.—Inflammation of the lining membrane of the abdomen. See cut showing the reflection of the peritoneum. Fig. 31.

This is a most dangerous disease which all classes may be subjected to. It is caused by exposure, colds, falls, blows, injuries, or may be caused by abscess of the liver, perforation of gastric or internal ulceration, as in typhoid fever. The patient soon dies in great agony. The abdomen is usually greatly swollen, and as a rule contains a large amount of fluid which is accompanied with sickening gases.

Death by Diseases Affecting the Liver.

Acute congestion and chronic congestion of the liver. It is said that Dyspepsia or intermitting fever, or remitting fever, may soon lead to complication like Hepatitis, Gastro Hepatic, Catarrh, inflammation and abscess of the liver and jaundice, followed by acute yellow atrophy,

and so bring on death by blood poison. Other forms of diseased liver are known as cirrhosis, or gin liver, fatty liver, waxy liver, or enlargement, syphilitic liver, cancer of the liver, followed by dropsy.

In Acute Hepatitis, an abscess may send a suppurated puss into the stomach or bowels, and by this means cause a great deal of gas and fluids to collect in the abdominal cavity, and by this reason cause death before any marked degree of emaciation has taken place. And when this does occur, great care should be taken in locating this fluid pus, which should be removed by the aspirator or trocar, when by filling the cavity and arteries and the lungs with a reasonable amount of embalming fluid, no serious trouble will be likely to occur. As a rule, all cases of liver complaint are of long standing, and this will use up the fluid constituents of the body, and so be in every way much like a case of consumption.

Dropsy affections are classed into several varieties, and so becomes a disease too complex for the limited space we have in this book, because, 1. Local infiltration of connection tissue. 2. General cellular dropsy. 3. Hydro-cephalus, and 4. **Ovarian Dropsy.** *Figs. 35-36.*

Obstruction to the organs of circulation—Absorption and excess of water in the blood are said to be the causes of Dropsy. Disease of the liver, heart and kidneys, and Peritoneal Dropsy accumulate water in the abdomen. While Ovarian Dropsy may be classed as ovarian tumor, which, if death has been caused by the malady, will cause the embalmer some trouble to keep well unless they draw off the watery fluids found within the abdominal cavity. The face, neck and arms may be emaciated while the abdomen is greatly enlarged. The quantity of the fluid is sometimes as much as 25 pints, which is generally clear yellow or colorless, albuminous and alkaline. Certain forms of Dropsy may fill and enlarge the seratum; also, Ovarian Dropsy, the last as well as the first, is bad to handle.

With Dropsy I find it best to tap the body and drain them well, and by injecting the arteries full of embalming fluid and in the meantime leave the abdominal cavity and other incisions open for some considerable time in order to dispose of all the souring fluid of the body. *See Fig. 28.*

But when death has resulted from the knife in hands of the surgeon (*See Fig. 35-36*), or soon after, there ought not be any serious trouble encountered after the water has been well drawn out of the body and then properly embalmed by injecting the arteries and lungs and thorax cavity, in all cases where the puffed condition of the

flesh remain thickened by reason of the fluids or gases.

Death by Diseases Affecting the Kidneys and Bladder.

CONGESTION.—This disease is similar to Bright's disease, and known as

URÆMIA.—This disease contaminates the blood and soon ends fatally by complication and blood poisons.

Blood corpuscles are sometimes found in urine and following this may come white deposits in other affections. A creamy white flocculent and at other times a greenish deposit is found and this forms a jelly liquid pus. While with other body fluid, blood corpuscles, mucus corpuscles, elliptical cells, tubular casts, uric acid crystals, phosphate and lime deposits, oil globules, fatty matter, gelatine, chyle corpuscles, lymph, albumen and sugar or possibly all flesh substance may become reduced to water.

In diseases like diabetis, sugar or glucose, albuminaria, albumen occurs and may follow such affection as scarlatina, diphtheria and venal congestion, and so may leave the body fluids in abnormal quality and various proportions of quantity.

While certain stages of other disease may have removed the greater portion of these fluids in some cases. There will be other cases when an over amount of these fluids will remain in the body.

When this fluid may be found located in the kidneys and bladder, it may be drawn off by the aspirator or some similar instrumental process, but when certain disease condition leaves this uric fluid within the blood and capillary vessels, much greater care must be observed by the process of treating the fluids found in that this class of deceased bodies, as against that of the emaciated classes.

BRIGHT'S DISEASE, or speaking more correctly, disease of the kidneys. A malady said to be more common in males than females and to occur more often between the age of 45-65. Death results through complications like pneumonia, peritonitis, dropsy or similar diseases.

Stone in the kidney or bladder frequently destroy life in men after 50 years old.

DIABETIS INSIPIDUS, causes an excessive discharge of colorless urine. Most common in men after 30 years old, and the duration may last but for a few weeks with some while in others it may last for some years.

DIABETIS NELLITUS is a form of disease which shows sugar in the urine. Is considered the most unfavorable, and the younger patients which show traces of

Diseases of the Brain.

this or albumenaries symptoms are marked as incurable, and hetic fever, diarrhœa or pulmonary consumption terminates the case.

Boils, carbuncles, gangrene may be found as presenting but a loathsome case for the embalmer to treat.

⚔ Dropsy of the kidney, rupture of the kidney, cancer of the kidney, tubercle of the kidney make a very serious class of disease maladies which take all ages from childhood up.

Death by Diseases Affecting the Brain.—Nervous System.

CONGESTION OF THE BRAIN.—The attack with adults is usually late in life: with children at all periods. Convulsions may appear, gastric fever, infantile remittent, cerebral inflammation and cholera infantum are frequently attended by symptoms of brain fever. Between the age of fifteen and forty-five is the age most subject to this disease complications, and the majority of cases die in convulsions in from a few days to a few weeks.

DROPSY of the brain is usually an affection of early life. These usually die in a few months.

SOFTENING OF THE BRAIN.—Abscess, sometimes gangrene result from injury. Generally most cases die within two weeks, frequently in two or three days.

“**WHITE SOFTENING**” or degeneration of the brain may result from old age, intense mental labor, or intemperance are the usual causes of this disease. Death always follows after a period of a few months at most.

INFLAMMATION of the spinal marrow. Spinal meningitis, inflammation, ulceration and gangrene. Similar to cerebro-spinal meningitis or spotted fever. Death the rule.

SUNSTROKE.—Severe cases may end in death by convulsions or be followed with more or less serious consequences through various nervous disorders.

Tetanis.—Lock Jaw.

A disease characterized by certain contraction of the voluntary muscles. This disease has two or three forms. The most fatal is caused by an injury, such as lacerated or punctured wounds, sometimes amputation and other surgical operations may be followed by sensitive spasm, ending in death in a few days.

Diseases Ending in Death by Hydrophobia.

This horrible disease has been disputed by some prominent physicians, who term the attack as being tetanis or lock jaw, since the symptoms are so very similar. A

month or more after the bite of a rabid dog or other rabid animal, the wound having healed, irritation commences in it, spasm, gasping and choaking, intense thirst and great distress followed by death in from four to ten days. It may be well to say that canine madness is not restricted to hot weather but may occur at any time of the year.

Death Ending in Delerium Tremens.

Intemperance followed by sleepless nights, great prostration. Death must result within a week or two at most if sleep is not obtained. As professionals, we often hear the remark that such and such persons are already picketed, but experience with many such cases, show the writer that all such are far from being embalmed, for the flesh condition, coupled with that of the fluids of the body, are far from making such cases favorable. The truth is, all such are quite the opposite and very active measures must be taken in order to successfully embalm them.

Dangerous Contagions.—Diseases Ending in Death from Morbid Poison.

Epidemic, eruptive and contagious **Malignant Smallpox** attended by violent and rapid prostration; attended with pustulation and sometimes a livid eruption of the skin; abscesses in various parts of the body; hard glandular enlargements may occur. Thousands die annually. While smallpox may be successfully embalmed and put into condition to make such subjects reasonably safe to exhibit to their friends, my advice is to keep away from them, for the smallest oversight might cause very serious trouble to follow. Therefore let sanitary physicians handle and direct the disposal of such cases.

Measels.

This is a contagion with children, though in the late war there was a disease called camp measels. This assumed a typhous character and many soldiers died with it. Diphtheria and consumption may follow with fatal results.

Mumps may affect the brain by sudden attacks caused by exposure and will cause death in two or three ways of complicated inflammations. Death is rare with hooping cough. Exhaustion, pneumonia and consumption may follow this trouble with children mostly,

Death from Diphtheria – Membranous.—Putred sore throat epidemic of it may be in general or confined to

local districts, and there are four general forms of this disease—the Copous, Ulcerative and Malignant.

The first causes the greatest number of deaths, especially in children, as this form of the disease seems especially to follow measles or scarlatina. Great discomfort in the throat followed by an abundant brownish leathery exudation is found to cover the tonsils, which are greatly swollen, when the obstruction to breathe causes death by asphyxia in a very few days.

In Malignant Diphtheria, the leathery coating changes and the tonsils and glands enlarge and become black and give an offensive odor. Great prostration followed by clammy coldness coma often precedes death, which is usually in from three to five days.

Dangerous Glanders.—It will be important to know that this disease may be taken from the horse. After a few days incubation fever and pain similar to rheumatism, followed by red patches over the body, gangrenous pustules appear on the face, muco purulent discharge from the nose, fetid odors and death within three weeks.

INFLUENZA—Epidemic of Catarrh.—Mortality of this disease is far the greatest with old people, as they are especially apt to be carried off with it in some complication like Pneumonia or Influenza. This disease is sometimes called the Grip.

Fever.

With Typhoid Fevers and other maladies, like nervous fever, common continued fever, enteric fever, abdominal typhus fevers, peripneumonic fever, and several other classes, which, owing to the many complications, cannot be described in this work, but to give the embalming student an outline of these, I will say that with the advanced stages of all classes of fevers, the patient is overcome by great languor, and usually there is great emaciation of all the body substances in the typhoid form, bed sores may supervene, suppression of the urine, hæmorrhage from the bowels, cold sweat, possible abscesses may appear in various parts of the body, such as in the glands and connecting tissues, but what is of the most dangerous nature is, the intestines may become perforated by the deep ulcerations of what are known as Peyer's Glands, causing death. By this or various other stages that may give the embalmer more or less trouble, owing to the physical derangements which follow, or by some fatal complication like that of Suppurative peritonitis, pneumonia, inflammation of the brain, when recovery is said to be of rare occurrence.

MALARIAL FEVER—Intermittent, Remittent and Pernicious Fever.—With the first short high fever, though enlargement and softening of the spleen and engorgement of the liver, or Dropsy may follow. Remitting or Billious Fever with high pulse, 110 to 115 beats

per minute, followed by inflammation of the brain or Typhoid Fever.

Erysipelas.

This disease has two known varieties, and are called traumatic and idiopathic, and are diseases which may become local or general, though the eruptions most often occur upon the face, and slowly spread from part to part, when moderate heat and swellings may be followed with eruptions all over the body and possibly cause suppurations or sloughing that may involve the subcutaneous cellular tissue, especially upon the limbs. The danger of the disease itself is in the traumatic or secondary erysipelas from that of injury or abscess, which it starts from. The disease has no definite period of duration, but may be followed by delirium, inflammation of the brain or fatal coma.

Professional Dangers.

Were all the embalming students permitted to visit some of the great hospitals in company with the medical students as they make their trip in morning clinics, and be enabled to see some of the many loathsome diseases with their various disgusting body marks, it would then be scarcely necessary for this word of caution upon what relates to dangers of handling such bodies, and especially so when they know that under trifling conditions this septic poison may be transplanted upon their own bodies through contact with a slight abrasion or sore on the hand or wrist. And in pointing out the various classes of diseases which the embalmer is cautioned against, it may be said that it is not possible to deal with either one of them more than as a matter of caution and how to avoid all of them. There are now many volumes which the science of medicine has given to each one of these diseases, and the vastness of this history makes it quite impossible for me to say more concerning them farther than by name and what the nature of these diseases and the dangers are, and how it is that much of such diseases may be avoided. For I am told by good authority that there has been several prominent physicians who transplanted upon themselves some of the loathsome disease from the patients that they were treating at the time.

SYPHILIS.—This disease is generally an infectious disorder—both acquired and transmissible by inheritance—and according to Dr. Jas. N. Hyde it is chronic in course and displaying in a determinate order specific symptoms, which may be declared in one organ of the body or simultaneously or successively in several parts of the body. It is to be classed as a virus infection, and the embalmer should know that this infection is due to the invasion of the flesh tissues of the body by microorganisms, whose identity and relations have not yet been established as in other diseases of the same class, such as tuberculosis, lepra, and mycosis fungoides.

Surgeons have been inoculated by manual contact, both in operations and while engaged in work of autopsy, and chancre of the toe, nose and upon various other parts of the body, by some accidental contact with the virus, known as granulomato, which is always marked by some local lesion, and all scars, pustulu, chancre, sores, ulcers and skin disorders must be avoided at all times. No matter what the social standing of the person or the families may be, for the greatest dangers may lurk with even skin pimples or some slightly morbid skin derangement.

Dr. Morrow says that the changes in the skin caused by syphilis embrace almost every form of lesion which the structure of this organ is capable of producing—Macules, Papules, Pustules, Bullæ, Tubercles—while it is to be regretted that the secondary changes of scalded portions of the skin cannot be shown both in colored pictures to illustrate its many varieties of cutaneous manifestations of the aquired form of Syphilis, as in crusting, ulcerations, and cicatrization, that Dr. Morrow has shown by illustration, which so closely imitates every variety and form of syphiletic lesion, and the eruption skin disorders which are due to the most dangerous classes and conditions of that disease.

The embalmer should guard aganst making any contact with the poison from all eruptions, pimples and sores found upon the bodies of the dead, and especially that class of cadeavers in the advanced stages of putrefaction, as cadavic poison is considered highly poisonous, and should some accidental cut or abrasion of a hand or finger be brought into contact with such poison, no matter whether it be a case of syphilis or not, great care should be taken to have the wound cauterized by some doctor, in order to avoid the possible danger of its being inoculated. And while embalming fluids are supposed to distroy the septic poison from all flesh substances, yet there are but few responsible guarantees that these embalming preparations will be any absolute guarantee in destroying all the septic poison from any particular gumatuous deposite, or pus from various ulcerative abscesses, and the infiltrations of either fluids or gasses from any kind or class of animal putrefying substances, no matter what the original disease or cause may have been.

There are many forms of Syphilis and other venereal disorders, and then comes such dangers as from diseases like Glanders, Influenza, Malignant Diptheria, Black Erysiphilis, Small-pox, Yellow Fever, and perhaps a few other epidemic and zymotic diseases which are considered so dangerous to the public, and are also so varied and complexed in what pertains to a proper history of each of these diseases, that I feel it my duty to say to all true students of the modern embalming art that as these above diseases are now to be considered under the strict supervision of a sanitary board, comprised of men skilled in dealing with these epidemic and contageous diseases, and it becomes the duty of the embalmer, as a good citizen and an intelligent, professional servant of the public, that whatever cases of any of the above diseases

he may be required to professionally handle, all such work be done only by and through the co-operation, and under the strict supervision of at least the majority of the sanitary boards, which the state laws have appointed to look after as a public safeguard, and to do otherwise would not only be a disregard of the opinions of men who are much better acquainted with all that pertains to the history of sanitary sciences, but it would lower our professional calling as specialists in all those who place their reliances upon the known and established sciences of the medical profession, as perhaps, the greatest savants of humane happiness.

Unprofessional.

What ought to be discouraged is those men who advertise themselves as being arterial embalmers, cavity embalmers, scientific embalmers by the latest and most perfect process known to the art, or by them discovered in the art of embalming which makes the worst cases keep and look lifelike, and a long line of such profound wonders, which the world never heard of until the self-blown card was printed to announce their various names to the world in just the same way, and for the same purposes, as that of any other false doctor or so-called scientist.

In considering the question of embalming remedies, it may be said that, as the business grows in its advancement to that of a profession, there are many new things which come to the light by a better understanding of what are now required of this art to meet the demands of modern public requirements.

When the use of ice was discontinued for the many conveniences of stomach and cavity embalmers, it was supposed by many that any fluid preparation which would stay the process of flesh decay for the usual two or three day retainment of the deceased was quite as much as was required of any embalming fluid, but time and a closer observation of the results of so much of that work has shown the more experienced so many things which were not known before, and now what was once supposed to be quite satisfactory results of this cavity work, is now seen to be so far from being what it ought to be and, perhaps, the first great step toward advancing our profession in their own work was when they (the profession) were told how to disperse the gasses from all the various body cavities, and then how to follow this up by a thorough system of arterial embalmment.

For the time any one embalming fluid was supposed to be all that could be used. Since it is true that to rout all the gasses, and then injecting the cavities and principal arteries, was a grand step toward the method for doing good embalming work in many cases, but it was a mistaken idea on the part of so many who, in various ways, were deluded into believing that by the use of some particular fluid of which this party had once or twice used, and as from what little they knew or could see, they supposed that they were embalmers of the highest class, since they had kept a deceased body, which apparently was perfectly embalmed. When

they lost a case they changed the fluid, supposing that it was not good, while many of the profession explained to the friends here that it was one of those specially bad cases which nothing would keep.

Recent papers are now setting forth the necessity for two special classes of embalming fluids. Quite an idea. Should any fluid be used and fail, this can be charged with using the wrong fluid, but the truth is coming closer each year to what Renouard and the writer each said concerning embalming progress many years ago, and this was in substance that each year would bring forth a new understanding of the requirements of every case to be treated until finally specific remedies would be made use of much in accordance to the self observations and practices of those engaged in the professional work, and when there was shown to be any internal derangement of either a local or general character that disease or injury may have caused, which in this way may cause such obstruction that the usual process of embalming then cannot be carried out—as abscesses or eruptions might cause—then neither the arterial nor the cavity process would not always supply even a partial embalming by the saturation, by which the process of anastomosis ought to supply, were the embalming fluids made especially for that purpose. The flesh tissue can not absorb any chemical sufficiently when the fluids corrode or saponify their surfaces as soon they come in contact with them, and while some bodies do require that class of chemical compounds, yet in this case something else must be used that will slowly but surely saturate every flesh substance which it comes in contact with, and when one will not do for that case other formulas must be resorted to in order to put all the body substances under the specific controlling influences of that special drug or compound which each variety of disease or injury may require. If all diseases and all putriscions were each one and the same, then one pill and one balm would possibly meet all the requirements of each bodily disease and each bodily dissolution.

But it is true, that neither the diseases nor the results of their morbid attacks upon the body physique are to be found alike. Sometimes even the same disease upon different occasions are not to be found exactly alike, though apparently under the same conditions; yet the physical structure is rendered vastly different in both the morbid obstructions of some local or general derangement of the internal body, as well as by the necrodies conditions, which all or certain portions of the body substances may be reduced into, by reason of the variances of the morbid attacks. All this, under certain conditions, which give the causes when brought into contact with a drug remedy for the one, may give the cause for destroying the other; and this, by reason of the combatible tendencies of the body substance with its chemical opponent as found in some drug which, though under other conditions, would become a true embalming remedy. Or, to be explicit, the body substance may be rendered alkaline under cer-

tain conditions. While a strict *acid character* may be given to all the *body substances* as the result of other pathological or morbid causes—and if the embalmers would be able to know all the true facts as to what the body substances are, and what are the chemical basis of these various body substances, then it would not be much of a task for them to supply either a neutralizing agent or some temporary specific which would directly or indirectly supply a means for influencing a more or less useful remedy, if not a substantial embalment of the bodies which they may undertake to treat in a more successful and professional way. If we would do so it must be done by a methodical and scientific treatment of the body substances, and this in strict accordance with the various chemical laws that show us what the *primary acid* or *alkaline bases* are, which the varied morbid attacks of disease may have produced with the flesh or body fluids of any and all classes of deceased bodies. As the normal functions of life are made to deviate by the influences of disease, so will the process of putrification deviate with various chemical bases and various stages of the body substances which make the propagating medium for various animaculations.

Practical and Thermal Embal- ology.

As it is true that the embalmer must deal with the various processes of both animal and vegetable putrifaction, then it should become our duty to enter directly into all that pertains to each of the individual substances of the deceased body which may become involved by the primary stages that foster decomposition, and so by this become more fully equipped with such knowledge as will enable us to deal with each specific class singly or collectively according to the possible and probable course which either one of them may take.

If there is but one process of putrifaction, then one class of embalment ought to provide a remedy for this, but if it is truly shown that there many processes of putrifaction, and that there are many varieties of matter which under many ways may become involved by the first stages of putrifaction, then it will follow that if we would be logical and methodical each class of body substance and each kind of fungus ought to be separated into that class or group to which they belong, so that a specific law may be defined into special measure by which to deal with all the varied destroying tendencies that may or may not surround them.

We are told that with certain class of diseases like fever may be caused by zymotic influences, and again that fevers are diseases which exhaust the fluids of the body. While with other diseases, instead of the fluids being exhausted some single organ of the body alone may be destroyed by the wasting effects of that specific influence which the specific disease may direct upon the single organ of the body and so by this manner sooner or later take away life. Then does it remain that the embalming process or the embalming reagents will, or even can be the same in each of these two distinctly and varied conditions which each body physique will show as the result of a specific cause?

In order to meet the requirements of each of these diseases the doctors and the scientist have each one made a specific study in hopes to find or reason out some

specific medical agent to either cure or stay its ravaging process of vital destruction. So the doctors carefully and thoughtfully observe and note the first predisposing symptoms of the disease, its course, progress and final culmination; then the scientists also become interested and study theory by methods in order to specifically prove the actual causes, its origin and its progress. Armed with the history of its origin and his thorough acquaintance with all primary law of chemistry and the scientific facilities of the microscope, he sets out upon the experimental field in order to find and establish a true remedy. But this is only by such laws of cause and effect as are worth the consideration of his profession as man of the true sciences.

Now that it is true that the modern embalmer is making anxious enquiry into ways and means for cultivating his mind into the broader and deeper fields of embalming, and that vast field of undiscovered science, and this is not an idle curiosity on their part but it is that as professional men they begin to see their professional weakness, and they are tiring of these so-called wonderful discoveries called wonderful secrets, and as intelligent men they desire to know the truth by such proofs as will demonstrate and develop an intelligent knowledge and understanding of all that pertains to the advantages and disadvantages of this, a professional work. In doing this the writer fully believes that the microscope with various strong, hand lens will be required and used for inspecting the remains of the dead in order to determine the actual condition of the body substances which to know the truth may be classed into groups of varieties, as they relate to the physical and morbo-pathological, and are shown to belong to the various families of micro-putrescions.

And as the late Dr. Charlot tells us in his memoirs of the great French Scientist Pasteur, just published in the January, '95, number of the *Cosmopolitan*, there are yet many unknown laws which control so much obscure phenomena, and we may find that this is no less true with the questions of spontaneous generation, or germinations, in the question of diseases than it is with the one great question that today is baffling the higher advancement of the Embalming Necrocedialist.

But if we try to appreciate the true worth of what Mr. Pasteur has done by his faithful methods of experiment, which for so many years he has scrupulously developed and analyzed that law of the phenomena, which has heretofore obscured the first stages of the putrefaction of animal and vegetable substances, and with this Pasteur's great labors break forth with his inflexible logic. and shows us that the first link of the chain was the discovery of animated germs; and to go farther he shows that these germs are

not spontaneously produced, but that this fungus, or Baccilli people the atmosphere in all that surround us. And we are also shown that by ebullition or dry-heating medium (such as flesh and body juices) this dry heat will temporarily rid that substance of these micro-germs, even while in contact with the air. While if this substance be sterilized (dry-heated) and then sealed away from all further contact with the air there will not be any showing sign of putrefaction. This is given us as conclusive evidence that organic putrefaction does not result from a purely chemical action, but is determined and governed by the intervention of living germs by the development and life of inferior micro-organisms, and today this Pastorian theory is no longer a theory, but is now an established science; and as such, we must confess, brings the writer down from an opinion given in the *Casket* quite twenty years ago, under the head of "Rapid Decay, or the Spontaneous Dissolution of the Humane Body." In that article it was given as our belief that all these micro-germs was produced first by the Gastric acidity with the organs of digestion, as it made a gaseous, or chemical inroad through the fluid and fleshy substances of the body, for the spontaneous invasion of what the Bible calls our skin worms. And while in a great measure this may be true, however, as oxygen is the acknowledged scavenger of the earth, while nature in various ways may produce specific amalculations under what Pasteur's observations and experiments show are the only condition (moist air at a nominal temperature) by which to produce either one of the many varieties and classes of Baccilli, which the embalmers must now find ways and means to destroy, or retard.

Review of the Putremology of Baccilli.

As the albumonoid substances decompose rapidly we may distinguish them by the fact that when dead animal substances are exposed to the air in a moderate warm atmosphere putrefication softens the albumen substance and the products are a certain fetid gas, carbonic acid, nitrogen and ammonia which denotes putrefication. The rapidity of putrefication in animal substances varies with the consistency of the body fluids. The softer substances undergo the change most readily. In the first place putrefication requires the access of atmospheric air or when that is excluded, any fluid which contains oxygen will carry on the putrifying process more or less according to the state of the substances which may be combined to undergo decomposition. Emaciation retards putrefication while moisture and warmth will facilitate the more rapid process of dissolution.

The process of putrefication is accompanied by the growth and multiplication of a microscopic vegetable

organism which, both Carpenter and Prof. Dalton say, are analogous to that causing alcoholic fermentation in saccharine liquids. The first stage is called fungi, which is due to minute vegetable cells of very simple organization which rapidly multiply in the decomposing liquids first and following by the cadaveric softening of the flesh tissue by the cell which belong to that fungus genus bacterium, so-called from the rod-like form and the species found in putrifying body fluid. Infusion is known by the the name of bacterium-termo. The cells are of an oblong form. These multiply by spontaneous diffuse which soon break up the form into a mass of which rapidly waste away as fetid gas and watery ammonical vapor. One of the most remarkable characters of bacterium cells is their movements, for the microscopist tell us that during a certain period of their development they exhibit an incessant motion, constantly in a conical rotation about their longitudinal axis, by which they are transported in various directions. The motion is often so rapid that it can hardly be followed by the eye; in other instances it is so slow that its mechanism may be distinguished and this movement and the multiplication of miriads of cells continue while the putrefaction continues. When all the albumoid ingredients of the infusion have been decomposed, the liquid again becomes clear and the bacterium all subside to the bottom in a quiescent layer; but should there be something like a jar occur, like that of removing or transporting the body, then possibly the gases might displace other albumenoid substances of the body and by this way re-excite a renewal of the elements of putrescence as these microgerms will again cause the same condition of decomposition to take place as though there had been no interruption. And now what has been shown by the manner of a locality or a cavity fluid space regarding the bacterial destruction of a given quantity of these albumenoid substances, may also be, in a manner, caused by the chemical action of the embalming fluids as it may temporarily destroy the albumenoid substances so that this micro cell can not make use of it, but instead of destroying these organisms of putridity they only stay the putrifaction process for an indefinite time; and to explain the reason of this, is, that when the embalming fluid is placed within the body by the present methods, there is a strong probability that but few of the body cavities are saturated with the chemicals, in other words we fill the big spaces and trust to luck for the smaller ones. Anything that is called an improved embalmer is bought and used regardless of its origin or adaption. One says that it is an amaciator, or that it is alcoholic, or fra-

grant, a permeater. We buy and use them all, for some one many years ago said that an embalming fluid must possess these chemical properties; but why not use pills or some kind of formation which possesses two thousands ingredients under a sworn statement of the inventor of such a wonderful idea as to what pertains to the true embalming science.

I do not mean to cast a reflection to but one thing and this is in the fact that all classes of drug compounds will not pass into the small capillary cells of either the blood vessels or that of the lymphatic system. While it is true that certain compounds are made that will not only do so but they will also destroy and break up the possible existence of all classes of micro sporing cells and consequently there can not be any process of animalculating putrifaction by which to carry on the work of decomposition, however, I do not desire to be understood that embalment is to be made absolutely perpetual for this would belie the truth of nature's laws, yet, the word absolute may be actually accomplished by the same measure as in that of all other human achievements. When once the embalming profession eventually set to work by methodical ways for reasoning out that which is known as true ways and means by which to carry on all this professional work of embalming as by the chemical law of cause and effect.

Reviewing Embalming Operations.

In considering the questions of Embalming Operations, and methods for treating the many classes of diseased bodies. With the many varieties of diseases and death causes, and all these with their multitude of physical and morbid hindrances, it may be said that the modern embalming art is no longer to be classed as being anything less than a progressive science which is full of hidden mystery, and is so locked up, by so much of that phenomena which nature's laws maintain, that to-day nothing less than the studious culture of all that relates to these science methods can enable anyone to perform such embalming operation with any degree of success, except by the personal qualifications which they must obtain through some properly acknowledged channel for teaching all that is known, as being the first fundamental law principles of the embalming art sciences. But before we enter upon this subject I will say that soon after this there was a stranger came to Chicago with a device similar to a Babcock fire extinguisher and proposed to embalm all kinds and classes of bodies by saturating the whole inside of the body cavities and arteries, veins and lymphatic vessels with a so-called secret compound gas, which was used under pressure at a hundred pounds or more. He proposed to completely saturate every cell and tissue by this chemical process,

which was said to embalm and preserve all by a kind or peculiar effervicorating influence of the chemicals. But this great and wonderful process, after being introduced on test cases, only proved to be a greater influence for destroying the bodies of the dead than when they are buried in quick lime, and there was no manner of embalment shown in the bodies which were experimented with, though it would seem that some gas or some vapor might yet be discovered that would evaporate the flesh juices, or neutralize their fermentive tendencies, but how is the question?

During the last fifteen years my study has been to make a chemical assimilating compound which would enter into a further chemical action when placed in contact with flesh cells, and by this create a volatile and drying influence upon the albumin, sugar and oily substances of these flesh juices. With this there is no trouble in cases where these juices are not too far isolated by deep glands and flesh cells. But where these fluids are deep and the arteries and veins are obstructed in any way, I find that it will take some hours to complete the work to a point of safety, especially if the subject be one which has the soft fine flesh tissue. The formula (*See Emb. Fluids*) can be relied upon provided the operator does complete and careful work. However, every cavity and organ of the body must be treated with great care.

What I have wanted has been to find some compound which would form a drying gas by the action of the chemicals upon the flesh juices, and by this means impregnate the flesh cells through by diffusing the lymphatic system and similar fat and gland substances of the entire body, and so instead of destroying the body form of the flesh, as the fire extinguishing process I spoke of done, it would embalm the body by some manner of a harmless chemical assimilation, and at the same time accomplish this result in a short time by a simple and practical way.

Embalment of Consumptive Bodies.

This disease is so well known that we feel that it is not necessary to advise the undertaker or embalmer of to-day as to how they must treat them, for it is true that if any one class of disease is better or easier kept than another, it is the one emaciated condition of the body by Consumption; and if the embalming novice desires any easy subject, "we recommend this disease likely because of the emaciated condition of the dead" to begin the first work of embalming and keeping bodies without ice. This one disease has been the stronghold for beginners for making the first step of a professional reputation, and while we respect these as the first bodies which the beginner could keep, yet there are those who place too much laudation upon the results of their work upon such bodies. Especially is this true with all emaciated

cases. None but **Hasty** or **Galloping** Consumption is excepted, for with this disease, which lasts but a few weeks, we may have no emaciation of the body, and so all the fluids and fats even to a fact of corpulency, or the most robust classes of children or adults may be taken by the last named disease, when the embalmer must operate by the most careful methods. But as for the old stages of emaciated bodies I will take the liberty to say that I will agree to embalm any one of these above the age of 20 years and upwards, and do this with **Salt Water** and the use of my instruments, or with lye water, and no other chemicals whatever, and when through this treatment the flesh will soon dry and the body will keep as long as six weeks. After that they will take on a dry mold; or cadeavic softening; or a shown process of decay. But when we talk about the fermentive process, or the gaseous process, and the forms of various processes of putridity. There are but few consumptive cases that will have fluids of the body remaining in any quantity, and dry flesh will be slow in forming any process of decay after they are properly washed and laid out upon a cooling board. I will say further that these all dry emaciated bodies may be easily mummified by placing them out where the sun can shine upon them, or it would do better if the bodies be placed into an out-shed and dried by the free circulation of dry wind or cool dry air. The truth is that if it was possible to take all bodies of the dead and thoroughly wash out all the fluids of the body and then thoroughly dry the cavity surfaces. We would then be enabled to render better work than can be done upon the bodies of any that are not emaciated, but as this is not possible nor is it ever likely to be so that modern undertakers will take the bodies to working rooms, as the Egyptians done. So we must learn of other methods and processes which will enable us to accomplish the best results of embalment under those natural hindrances we find on entering the death chamber, and it is the purpose of the writer to show as far as possible all of those predominating features which are the result of various classes of disease, not only of the lungs, but so many other diseases of the various organs of the human body, and so by this means impart to the embalmer such knowledge as will enable them to use their own judgment in all cases. When the embalmer can know the primary causes of death, then they may see or be able to foretell of the consequent results in each and every case, and this will enable them to operate as each case will require, and thus by means of true methods and greater experience each operator may be able to do the work of

embalming in a way more safely and satisfactorily to themselves, and thus save time and further annoyance.

Stomach and Bowel Trouble.

How to treat and embalm a case after death by diseases of the organs of digestion will involve many cases of both children and adults. *See Diseases and their Complications on Page 112.*

Operation.

In order to prepare the remains of such bodies for burial services, the embalmer will find the greatest difficulty in destroying the source of these ammoniacal gases which will seem to come from every part of the body. My plan has always been to insert several tubes into the stomach, transverse colon, the lungs and bladder and then also take up several arteries and after injecting the arteries work the various open tubes so as to rout all gases. I then inject the lungs and use care to get just enough fluid to counteract the fermenting there. Then, inject the cavities of the abdomen. *Fig. 30, 31, 33.* This ought to stop the gas formation, if not, there is still some cavity which the fluid does not reach. Inject the arteries again. If this fails, it is because the fluid is not good and this is now a chance to prove what fluid is worth, whether good or not, and the test if good is the thickening of the walls of flesh of the lungs and all fatty substances will soon relax and then the blotches of the face will begin to disappear so that after a few minutes the face will be all right and clear from both the gases or dark blotches.

In all adult cases of soft texture of the flesh like that of a plump round form of body in children, like many persons are classes which only a true chemical reagent will embalm. Salt and arsenic or lye potash nor sulphuric acid embalming fluids will not correct and keep these bodies for more than a day or so at best, but we must use a strict chemical assimilating preparation, if any permanent embalming is required, and so it will be that similar difficulty will be had when trying to correct several diseases like colic which so often terminates fatally to both children and adults. Bilious colic, gouty spasmodic colic, lead or painter's colic, cholera morbus or cholera infantum with all these and similar diseases there are to be found more or less trouble in embalming the bodies for they are all more or less sudden and so we may expect more or less fluids and the consequent results of an ammoniacal gas which thickens the flesh of every part of the body, and so these must be classed and

treated as the worst forms of cadavric. *See fig. 30, 31, 33,*

Few maladies present themselves as being more difficult for the embalmer than death by obstruction of the bowels, which, during life, is very similar to that of colic.

How to Treat and Embalm the Drowned.

DROWNED.—Remains that have been in the water until they float may fill the flesh with water gases and look similar to that of a case of Dropsy. As the process of gas fermentation which takes place in warm water or exposure in part to the air and water, will become completely water-soaked, and when this is the case the flesh becomes very tender and it will be found that the arteries are easily ruptured and cannot stand much pressure of the fluid injection. My plan has always been to place some burlaps under the body and strip off most of the clothing while the body is still floating in the water. By this means I **avoid all the stench** by immersing the body while I use the knife and open up the abdomen and thorax and such other members and organs of the body as may be engorged by either gas or water. A liberal gash from the back of the neck, arms and legs will do much towards recovering the body to a presentable stage, and after a rensing the body may be lifted out of the water, and when washed and wiped dry may be further treated with arsenic, salt or plaster of Paris to dry up the escaping fluid, and after a liberal wash with the embalming fluid it may be dressed and conveyed or coffined and buried in the most satisfactory way.

I once prepared a body, which was found floating, in this way and the remains were taken home and kept over night, with ample time for a funeral announcement, and the deceased was viewed by all with no small degree of satisfaction to myself as well as to the bereaved family.

Very nauseous and putrid remains should be placed in a bath-tub of water, which should be kept over the body and running off, and by this means the water will absorb all the stench, as the ammonical and sulphurated and phosphurated gases are washed out through such deep and well divided incisions as may be found necessary. Cold water will in this way improve the body if care be taken to dry the flesh by wiping and then using some drying salts or solution.

Operative and Thermal Systems of Embalming.

COMMON OR CAVITY PROCESS—This operation is usually confined to the simple work of making one trocar, or needle puncture through the walls of the abdomen somewhere near the location of the trans-colonn. *See Figs. 28 and 30.* And as the needle passes through it is directed upward into the Thoracic cavity into the lungs, and if long enough might reach the heart in some few instances, when the embalming fluid is injected with no certainty as to where this fluid may be placed.

Next the long needle is directed downward with the same uncertainty as to what cavity or locality may be punctured, and if the body does not keep they do not see why, since they kept one or two bodies by a like operation and the same fluid.

Several well directed needle punctures into each of the various cavities would give better results by the fact that the gasses may then escape, and also for the reason that the embalming fluid would be distributed so as to partially correct, or neutralize, the first stages of putrescion, and especially so if the embalming fluid was good. But if we would properly treat any case as thoroughly as most cases require, the cavity process should be made in both the Abdominal and Thoracic cavities, but each operator should also include each organ of the viscera, heart, lungs, and such as the brain, the liver, spleen, and stomach, bowels and ulcers, foetal, and all morbid or false growths.

ARTERIAL PROCESS—This process should be considered from the surgical standpoint, and must provide ways for testing the actual condition of the arteries and veins, and should the vessels of circulation be complete and free from clots or ruptures they will convey the embalming fluid to all the flesh substances, provided that there is no other local derangement within these vessels, or the branches that communicate with them.

The danger of relying wholly upon the arteries and veins will come from clots, abscesses, aneurisms, local infiltrations of the heart, lungs, kidneys, brain, and organs of digestion, false growths or uterus and foetal derangement. And if we would render the embalming operations more secure, all the internal chest and abdominal cavity spaces should be treated by such needle operations as may be found expedient. *See Operative Embalming Surgery, page 50.*

Areolar Space, or the Superficial and Deep Muscular Dessication.

Operation Upon the Areolar Spaces.—By including the plan given above for performing arterial embalment this lesson may be confined to the special treatment of the areolar space, and if we consider this question we may treat both the superficial and deep faciæ, and all the intermediate space between all the muscles as well.

This plan was published in the *Casket*, of December, 1883, and includes a plan for drying the flesh tissue by the liberal use of the exploring rod as it is directed into the various principal spaces between the muscles from such local or general operations as the case might require.

Instead of using the exploring rod the needle can be deeply seated when both air or fluid may be pumped and rubbed outward by the hands into the more distant spaces between most of the muscular substances, and so come directly into contact with a great portion of the fatty deposits of the Lymphatic glands and adipose tissue, as well as to surround much of all other flesh or fluid substances, which could not otherwise be so quickly reached by the embalming fluid that is put into the arteries, veins, or cavities; and when the process of flesh saturation may conduct the embalming fluid to all these distant fleshy substances by the phenomenal process of Anastomosis.

THE ANASTOMATIC METHOD.—I may freely say that this anastomatic process will not be produced in anything like a mark of successful and complete saturation of all such foreign flesh substances, unless the fluid be made of that chemical quality which will yield its own chemical properties in perfect harmony with that phenomenon that produces the first result, as by the strange laws of Anastomosis. And to go farther it must be said that what is so well known of this process of nature has all been studied upon the fundamental principles of life, and this phenomenon has not been fully established farther than by the laws of contact, or rather that all flesh grows watery, and may also take up drug remedies by being placed in contact with them. But to say how quick or slow all foreign flesh substances of the body structure may be put under the direct influences of any chemical compound that may be put into the veins or arteries, or in any other cavity of the body is yet quite a matter of theoretical speculation. Though I am frank to say that of all methods or plans for doing the highest standard of embalment, we may say with both Hohenschuh and Renouard, that the Anastomatic Theory stands pre-eminently above all other plans for necropathology and for the coming necro-medication, and no doubt but that it will remain as the one fundamental principle by which to advance to the higher knowledge of chemistry of such remedies as may yet be brought out by some strict and considerate embalmologist.

The Needle Operations.

During the last year or so there has been some speculation regarding what is styled as the needle process, but Profs. Rhodes, Crane, Renouard, Sullivan and the author made use of these various plans for using the long needle, not only upon the ordinary cavities, but directly into the heart and into the Bassillar veins through the inside corner of both eyes, and by this means place the embalming fluids directly into both the hemispheres of the brain.

As for myself I have found that the same result can be attained by putting the trocar through the cartilages of the central division of the nose. And while some experience is required, in order to know just how to direct and force the needle into the brain by this nose operation, yet there ought to be no trouble, when the instrument is properly directed through the nasal division cartilage and when the operation has been performed there will not be that wound injury to show, as it always is when the eye process is used for treating the brain.

Another good cranial operation may be made behind the head at the base of the skull. When by throwing the head slightly forward the trocar may be directed so as to reach the brain of both hemispheres. There should be some time given so as to inject the fluid slowly. Dry rags or cotton may be used to close the wound in both this and the nose operation.

The single embalming puncture of the body may be well enough for many indefinite cases which by either great emaciations or other general physical condition that may occur to favor such crude methods of embalming such bodies, but to style this or any other single punctorial operation, as being an established science by either the process or the remedial agents which are to be employed, is far from being either a special or specific mode of the modern embalming art, worthy of any particular attention from those who are, or may become experienced in what relates to Necrobiatic metamorphosis, as well as by those practical and implicit laws, which is always behind them, to give us a reliance for success, more or less peculiar to each of the many known physical and other stages of putrescion and its corresponding ultimatium.

Fœtal Embalment.

A proposition of this kind has been talked about for some months past, and to outline the true living fœtal conditions which provide a true anastomatic system as the blood circulating medium from the mother to the fœtus, it may be said that death will in all probability either distroy or so greatly interrupt this fluid communication as to make a vast improbability for the arterial or veinous embalment of any unborn child. And while the anastomasing process does convey some of the more carefully compounded embalming fluids to some considerable extent, yet this operation could not be very highly recommended as

being in any way trustworthy, though there is no doubt but that some cases may be embalmed under favorable conditions.

Though to look into all the small intricate, arterial and venous branches, which supply the uterus body, the ovary and adjacent tissues, it will be shown that there can be scarcely any direct arterial or venous communication from the mother to the child; though it is true that the arteries of the Ovaries and Fallopian tubes are the ovarian from the aorta, and this and the veins anastomose and terminate within the uterus.

Then also there is no farther communication with the Placenta than by that of anastomosis, and is produced only by adherent contact with the uterus of the mother.

According to Dunglison the Placenta is a soft, spongy, vascular body, adherent to the uterus and connected with the Fœtus by the umbilical cord. The Placenta is composed of the umbilical vessels and areolar tissue.

The main function of the placenta appears to be like that of the lungs of the adult. It admits of the blood of the Fœtus being thrown to that of the mother, where it undergoes requisite changes, and it is also an organ for nutritive absorption. And according to Prof. Goodsir the veins of the placenta anastomose freely with one another, and give rise at its edges to venous channels, which run around the whole circumference, and the umbilical cord arises from the center of the placenta, though it may occasionally start from its edges. This organ is liable to inflammation, and also to fatty and calcareous degeneration.

During Fœtal life it is said that the whole of the blood of the umbilical vein traverses the liver before it enters into the Fœtal inferior vena-cava.

In speaking of Fœtal embalment by direct anterior or venous injections upon these vessels of the mother, it can only be accomplished as shown above, by the slow process of anastomatic saturation of the Fœtus through the supposable placental adhesion after death to the walls of the uterus. Possible, but not probable, circulation of the ovarian artery to the abdominal aorta of the mother, and as the child draws life from the mother, as a Parasite, by adhesion, death is likely to destroy the contact of the Placenta and the Uterus.

The trocar or needle operation, when carefully performed, is by far the safest mode for embalming both mother and unborn child, owing to false adhesion or congested tissue and blood clots that are likely to follow after death. (See *Womans' Ailments.*)

Reviewing a Case of Sudden Death.

One of the most frequent modes of death of very large persons is that of a sudden attack of apoplexy. (*See Page 110.*) The face is usually black, the body full of flesh juices, the body round and full, purging at the mouth and nostrils soon follows and to inject any fluid into the body seems almost impossible. As the face grows blacker the neck and lips grow thicker. The needle

or trocar fails to draw out any of the body fluids or gasses from the thorax or within the abdominal cavities and so the case is lost as it goes to pieces with its nauseous fetors.

A child, a school boy or girl, and in fact, so many persons die and are so rapidly destroyed that their family is not permitted to have time to plan and arrange the funeral as they desire. All this is because there is no known remedy at hand by which their remains may be successfully treated; or at least this is what the public supposes, since the well known undertaker has kept the remains of other deceased persons; but they have failed to keep most of the stout or fleshy ones. It may be stated that the reason for this is because both the public and the undertaker do not know the truth of this matter.

What to do in any and all cases of the kind may be best answered by showing the cause of this purging, why no gases were so be found and why the injected fluid made the face get blacker and the lips and neck become greatly swollen and distended. *See pages 32, 73, 85.* But, to be brief, the viscera has thickened, in the short time since death, though there are some cases when the great internal deposits of fatty substances are so great that there is great difficulty for such individuals in breathing, and some of this class of persons may die by suffocation. In many of this class of Necroses it will be found that the arteries and veins are also thickened by fatty degeneration and what blood fluids there was to circulate within the body before death, was dependent mostly upon the flexibility of the surrounding fleshy substances of the body. As soon as death was made complete, the body salts and acids set up an immediate process of chemical assimilation, and this mild process of decomposition soon produced gasses enough to thicken the albumen, gelatin and glucose substances sufficiently and so this thickening takes up all the room of both the chest and abdomen, and the result was purging and body expansion to its utmost limit. The gases cannot escape by any small puncture, as they are locked up within the flesh cells or small cavities. What solution there may be forced into the body cavities causes more purging from either the stomach or the lungs, sometimes both, while anal and renal purging may also follow.

Sometimes arterial injections may be made so complete, as to cause the embalming solution to be conveyed into all parts of the body, and in this way the fermenting and thickening process that is going on within the body may be stopped by the correcting power of the embalming fluid. Then apply the trocar to the abdominal cavities and see that all the reflected portions and cavities of the peritoneum (*see page 80*) have been opened up quite liberally, and then treat the thorax in the same way.

The embalming fluid ought to stop all the primary stages of this cell thickening of the glands and viscera. We may note the good effects of the embalming compound by seeing the body settle down with a good nominal face and other general appearances that are more or less satisfactory, and showing as the result that

may follow the vigilant application of practical embalming operations first, and by the well-studied adaptations of chemical agents as true and reliable remedies that may be brought into practical and successful use for embalming the bodies of the corpulent and abnormal physique. *See the following chapters.*

There is no credit for any science due to those persons who may have taken and embalmed a few of the most favorable bodies of either adults or children, for it is true that many of the emaciated class of bodies will keep well when hung up and kept dry and away from moisture and the flies, as these well known and favorable surroundings are all that is necessary after beginning with a body which possesses all the flesh-dried requirements as the two essentials for keeping those bodies, and it is not to be considered as the achievement of any science, but simply as the resulting work from care and proper attention, and nothing more.

Reliable Embalming Fluids.

In considering the important question of reliable and available embalming preparations which can be recognized as being true and specific embalming remedies that are worthy of any especial mention in this chapter, is taken without either the knowledge or consent of their present owners. While it is true that all these embalming fluids which are named in this article are proprietary remedies that are said to be compounded from secret formulas, yet it may be truly stated that each one of these embalming fluids are known to be formulated by only the strict and most methodical rules known to the pharmaceutical art science.

Since these preparations have become so well known and qualified in their various specific uses that they now become more or less of that nature that practically makes them into what might be considered here, as public property, and as such they must take the passing notice which may be given to them as they may relate to being *available remedies* for the present and possible future uses of the modern embalmer and specialist.

As it is true that but few of our profession are yet able to make any special study of either chemistry or embalming pharmacy, it will be necessary that something may be said that will give them a knowledge of at least a few practical chemicals; and while that is done elsewhere, there are so many times when the embalmers cannot supply themselves with such drugs or chemicals as they may require for the various formulas which are given. While we have great faith in the future question of non-secret embalming remedies, yet there cannot be any practical use made of them, other than as specific remedies for some specific purposes, as they may yet be observed and noted, when once this profession is brought up to the true working knowledge of the higher sciences of specific embalming remedies.

In judging the various fluids around us, we are compelled to confine our remarks to that class of embalming fluids which our associated acquaintance has given us, both in traveling and knowing what others have been able to do by the use of these fluids. The rating which is to be given each one will be from a personal test of each one, rather than by what any one has said of them, as this was made no small part of my study during some fifteen years past, in order to keep myself posted by making all manner of analytical tests of every variety of embalming fluid that was put upon the market. While studying each one of them by my own ways and methods for the purpose of proving the value or non value of each one, and this was more or less peculiar to myself. Yet it was not my purpose to be partial, but it was to know what drugs and chemicals the best fluids were made from, and how such drugs were put together, in order to secure the uniform and valuable results that was known to follow their proper uses.

At several intervals some of these fluids, which are now spoken of have been re-formulated, and while some of these have been greatly benefitted, none of them have been injured in the least, though I do know and can name a few compounds which are sold as established embalming fluids, which they say has never had a single failure. Yet these preparations were made in different ways and by different drug compounds, no less than three or four times each year for the last seven or eight years past.

Of course discoveries came fast with some of the would be professionals, and no doubt many of our profession may remember how it is that these preparations always make the worst cases keep for weeks and to look perfectly life-like and natural. One man was heard to say that the deceased looked ten years younger. But the maximum of a true profession is, that the embalming art may succeed by the application of its known sciences in the same ratio as with that wonderful art and skilled science of the surgeon. With surgery there are many extreme measures which are made use of, to the disadvantage of those engaged in that profession, and with embalming it must be the same.

Surgery has been made popular because of the cautious discussions of those who engage in that work, and nothing less than the same caution be required as to what is done by the embalmer, and this in the most discreet way, as the public regards for those engaged as embalming specialists will take its standing largely by what this profession shows, that their professional work really merits.

Worthless embalming fluid can not be detected by either a cheap or high price, but they should be taken up and tested by capable men, who the State should appoint as a special commission, in order to stop many fraudulent transactions, but as there are some well known fluids which may be relied upon, it is false economy to buy and use unknown compounds from any and

every professed embalming specialist until some proper account is known of them, and those who make and sell unknown embalming preparation, but the fluids which has stood the test of some years back, and what is more important is to know of the undoubted reliability of the firms which make and sell them, are such fluids as the following: Crane, Egyptian, Champion, Washburne, Hill, M. & L., Oriental, Utopia.

Hydro-Chloranum was placed upon the market some years ago, but this preparation was withdrawn from the market for the time owing to the cost of making it. In speaking of the higher classes of embalming drugs it may be said that some of these drugs and fancy embalming chemicals will cost as much as anyone could desire, since it is known that the Egyptian often expended great fortunes upon the embalment of their dead, and it may be said that the modern essential remedies, which must be employed for anything like a permanent embalment, will cost all the way from \$75 to \$800 for each case. Varied not only by the class of work to be done, but more from the variable, physical condition of the subject at the time of performing the embalming operation; the time required is from four to six days. Prices, \$800 to \$3,000 each.

PHYSICAL SIGNS.— Have not many of our profession already observed that the soft flesh texture of a child presents one of the most difficult subjects for the embalmer to keep, especially the round and robust child that has not been sick. Now, it is true, that the flesh texture of many adults is also soft and quite similar to the flesh of a child. But to show the class of bodies which all embalmers prefer and why some of those bodies keep so nicely we will try to show as follows.

It is true that many persons are not only raw-boned, but their flesh texture is dry and coarse, their arteries are large and strong, and the capillaries are large, and all the oily and flatty substances are reduced to a minimum, while the functions of the body are nominal if not exceptionally good, until some disease so afflict them and so destroy life by a stage of slow fever and complicated disorders, until their flesh juices are about all removed and all the flesh substances are dried by emaciation.

When such bodies are properly laid out and cooled, how nice they are, and of course they should be embalmed. But do not deceive yourself with the idea that this nice subject is all due from the result of either the operation or the fluids which were used, for it is true that the very next case, similar in every detail so far as can be seen, when given the same operation and same care, it may go to pieces in a few hours. But, my friend, let me tell you what was the difference, and you should be able to discriminate between them. The first has dry, coarse flesh texture and good organs to circulate the embalming fluid into every such vessel throughout the whole structure. The last one may be just as large and just as heavy, but when we look closer we see that the flesh is soft and more fluid like. Everywhere there

are visible marks of fatty and oily deposits throughout the whole system. and it will be found that the lymphatic system is made up of minute vessels and cells that contain lymph and albumenic fluids. While the arteries and veins are small, possibly they are so weak that they will rupture easily, so there can be but little, if any, embalming fluid placed at such places as required throughout the system. If this case is not well handled at the start, all the fluids of the body will sour and the result will be shown in a spontaneous process of dissolution, because the disease in the first place has not taken all of these body juices, as was done in the case above cited; and what is more the embalming fluid has no true chemical assimilation. Good strong brine would keep the first by injecting the arteries, and so it would keep the last, if we would cut the flesh up in small parts. But as this is not possible, the embalming fluid must be made upon a fundamental principle, and by men skilled in the art of chemistry. By this means alone the fluid will penetrate the whole artery system, provided we use the proper methods for injecting the chemicals into all parts of the body, as it may be done by those only who become skilled in the ways and means of modern embalming.

The subject of the fluid constituents of the human body has been spoken of by me some twelve or fifteen years ago and I regret to say that it has been quite impossible for me to handle this one subject as thoroughly as it should be for it is true that this subject would not only involve the chemistry of the human body, but would also require several chapters upon Bacteriology, and as space will not permit this I leave this subject after a word further concerning rapid flesh dissolution.

It is the flesh composition which makes one body different from that of another. Firm muscular flesh tissues have flesh cells of a decided structure, and when so these cells do not break down into watery and oily substances only by a slow process of decay. There may be present a large quantity of blood and lymphatic fluids, which, under certain conditions, may or may not sour or ferment. The presence of albuminous substances and the absence of saccharine matter would retard the process to a specific class of fermentation; in fact, a specific micro-germ, and so if we reverse this by taking out the albuminous substances of the blood and leave the saccharine substance, which is said to be very similar to "grape-juice," the same retarding result may occur, but when both are present in large quantities, then either one of these two substances will sour quickly by adding a little water, and so when a portion of lymph or water is placed in contact with either of the two mucous substances, like the soft flesh texture of the child or adult, mobility is fostered in every substance because of the component semi-fluids, which go to make up that structure, and is so related to give a ratio of putrefaction.

When all the arteries are free from blood clots, or are not ruptured, the embalming fluid can be felt as it passes over the forehead and at many other extremities of the arteries where they

lie near the surface. A slight cut at the inside of the toes and fingers will cause a small stream of embalming fluid to be shown while injecting the arterial system. Renouard's plan is to inject fluid into the arteries and veins by introducing the canula into the latter vessels and then draw this out, and repeat the operation until the vessels are cleaned from all dark substances, then inject the vessels full of embalming fluid and secure the openings.

By using a long exploring rod there would not be much trouble in reaching clear in to the upper part of the thorax, and so doing fairly good work to rout the gasses, and letting the watery fluids into the cavity space, when they might be drawn out. There are many cases of children and adults when this operation may be performed, and so avoid post mortem incisions. After injecting the arteries and veins, they should be tied and the wound should be filled with soda or arsenic and after plugging with cloths sew the wound closely and securely.

In case of any excess in fatty adipose, much of this could be removed by the hook process.

An emaciated body leaves dry tissue, dry flesh moulds and leads to the slower process of putridity. A purulent lung or any other diseased organ may cause gases to bloat the body or to become locally engorged, but when this has a proper vent it is not likely to again become engorged. Embalming drugs may also disperse the gases by neutralizing the putrifying or fermenting process, as it takes place within the body fluid or certain soft flesh cell substances.

A great portion of the blood will usually be found in the trunk veins, both above and below the heart. Professor Renouard's system for removing the venous flood with a canula by the Bracheal operates [*Fig. 8, page 60*], has many good points. Ray W. Hussey shows an operation upon the Femoral vein [*Figs. 22 and 23*]. Professors Barnes and Sullivan speak of similar operations. In the fall of 1876, I embalmed an 18-year-old girl by introducing the trocar into the heart from the right side at the base of the neck. After some minutes I began to think that I would not be able to stop the continued flow of the blood. I then dispersed the abdominal gases and injected fluid in that cavity and then continued to rub the face and neck downward, yet I would no sooner get my hand away than the surface would turn black again. I then removed the gases around the lungs, when the black fluid left the face at once. I then injected the Brachial artery and vein, and after closing the incisions, I had no further trouble. From that time on I made use of both the trocar and lung needle for similar operations upon the heart at all times when I deemed that operation necessary.

Abbreviated Embalmology.

Albumen is an immediate principle of animal and vegetable life. It constitutes the chief part of the white of an egg; it is found in the serum, chyle, synovia, serous fluids. There is not much difference in the chemical composition between animal and vegetable albumen, fibrine and casin; also the white of an eye. *See page 32.*

Albuminoid substances are said to occupy the first place within the human body, as they are distributed in every part, and "excepting water" are found more abundant than any other substance, as they are placed in diffusible and non-diffusible groups as the one constituent element of every fluid and every solid of the body. When dry these albuminoid substances do not putrify, but with slight moisture these substances become the most unmanageable product of the deceased body.

Cellulose-Granulose are starch products. The human body converts starch into sugar, and the sugar into glucose.

Glucose produces most of the fats and oils within the body. Glucose fermentation is due to the action of a colorless microscopic fungus, known as *Saccharmyces*, a kind of yeast cell growth, that decomposes the glucose and produces carbonic acid and alcohol when under the proper restrictions. Though when this amyloid substance (starch, sugar, glucose) undergoes decomposition in the manner of animal putrefaction, as within the deceased body, the process of that decomposition is shown by the thickening of the soft flesh cell structure of the viscera glands, a fatty, adipose substance, and the product is ammonia and sulphuretted and phosphuretted hydrogen gases.

Bacteria, Fungi, Infusoria—Microscopic organisms found in rain water and exposed organic matter by Leewenhock, 1675, and according to Dalton, Ehernberg, Leipsig, 1838 described as many as 700 different kinds that are called "animalcules."

While this class of micro germs have long been described as being produced by spontaneous generation, Pasteur and others have described and classed many families and species which are reproduced in the manner of the sexes, and thus some fifty or more different species of the infusoria are now excluded from the field of spontaneous generation. The group which comprises the general term bacteria is

classed as varieties of Bacterium, Vibro, Spiellum and Micrococcus. This group is the species known as bacterium-termo, and belongs to the phenomena of putrefaction. *See pages 88-89.*

Degeneration.—A change in the intimate composition of the solids and fluids of the body. In pathological anatomy, degeneration, or degenerescence, means the change which occurs in the structure of an organ when transformed into fat, as adipose or fatty degeneration of the kidneys, lungs, heart, or other transformations that are essentially morbid, as albumous, cancerous or tubercular degeneration. Virchow employs the term necrobiosis synonymously with degeneration. Sometimes the muscles are converted into adipose or fat.

Dessication, Drying—Dessicatives, remedies which dry up the flesh juices and moisture from the flesh solids.

Emulsion—See "Oleine."

Gelatin is an immediate animal principle; it is semi-transparent, insipid, inodorous, insoluble in cold water, very soluble in hot water, which it thickens into a jelly-like mass, and its presence causes clots and stringy liquid masses to be gumatuous and unyielding, while after death the veins and cavity spaces may adhere together by its presence.

Glycogenic Matter.—Glycogen, glycerine the sugar of gelatin. An albuminous principle produced by the action of caustic alkalies on gelatin, or meats. Glycohæmia, a saccharine condition of the blood. *See page 114.*

Maggots are produced in animal putrifying substances from the egg of a peculiar fly.

Sepsis, Putrefaction, Septæmia—Putrid animal poison, septic gases, purulent infection.

Septulum—A division between small spaces or cavities.

Septum—A partition designed to separate two cavities like the septa, which are numerous in the human body.

Sequelæ—I follow, as by the morbid phenomena, left as the result of disease.

Serosity, Serous, thin, watery, relating to the most watery portions of the animal fluids.

Serum, of the blood. This is the liquid which separates from the blood after death; it is usually a greenish-yellow color, viscid, slightly coaguable by heat, acids and alcohol. It is said to be composed of water, chloride of sodium (salt), certain phosphates and albumen, constantly united to soda, almost in a saponaceous combination. *See Albumen.*

Oleine—This, as its name indicates, is the representative ingredient of the oils, or fatty substances. When pure it is transparent and colorless, it retains its fluidity at ordinary temperatures, and even below the freezing point of water it readily dissolves both Sterine and Palmitine. The warmer the temperature around it the more solvent power

it will exert, and what the embalmer should know is that substances called **Oleine**, **Palmitine** and **Stearine**, are the most abundant fats of the human body, and they greatly resemble each other in the general character, though differ mainly in the degree of their consistency. The stearine is solid at ordinary temperature. Palmitine holds an intermediate position, while the Oleine is always the most fluid.

In considering the physical and chemical changes of the body fats, there are certain changes of conditions which both morbid or external influences may cause which in various ways produce certain characteristics that are peculiar to substances of their class. One is that by which an oily substance, when mixed with watery liquid, causes it to be reduced to the state of an emulsion, and so the oil becomes disseminated through the watery liquid. However, this change will not take place when oil is added to pure water, or to a watery solution of neutral or acid salts; but if a trace of alkaline carbonate be present, is when this disseminating change takes place, and in a like manner albuminous ingredients of the blood and other secretions of the body will undergo this emulsifying action when slight traces of some alkaline products are present, while if acid salts are present this chemical action is held temporarily in check. But to go further, all these fats may be saponified by the very same drug which causes it to emulsify, as by the proper and abundant use of some alkaline salts. But the embalmer must consider the important matter of chemical equivalents, in order for them to be able to obtain a desirable result, since it is true that there are so many other substances within the body which in a like manner will require certain specific remedies in order to modify their peculiar tendencies, instead of exciting the destroying influence, as shown above, by the chemical results of a slight alkaline influence when these oils and fatty substances are emulsified with water, and how widely different when saponification may be produced with the proper amount of this same alkaline.

When human fats and oils are maintained free from water, they will evaporate, grow rancid and gaummy. When damp and moist they putrify.

The salts of the body when undergoing death changes, will produce various stages in breaking down the flesh cells, as the body juices and the fats and oils become emulsified in accordance to the quantity and quality of these oil and watery substances of the body physique, and in the same ratio of this emulsification this will follow as the propagating medium, as the infusions for the spontaneous animalculations known as Baccilli.

Saponification, coagulation and dry emaciations will destroy all germ decompositions. However this is only dur-

ing the period that a perfectly dry condition is maintained in these saponified and coagulated substances and the ultimate results of dryness is that of evaporation and the wasting away as by the slower processes of decay and physical obliteration. *See pages 28, 32, 33, and 34.*

The following brief list of chemicals will show their action upon certain flesh substances:

Sulphuric acid causes starchy substance matter to swell; also thickens glucose.

Citrate of Mercury Acid colors albuminous substances red.

Diluted ascetic acid dissolves membranous and fibrous tissues.

Ether dissolves resins, fats, oils, when they are not saturated with water.

Chloroform, benzal, oil turpentine, carbon bisulphide do the same.

Alcohol dissolves resins and volatile oils, but does not act on oils and fats. It coagulates albuminous matter and renders them opacity. The last may be removed by soda.

Salicylic acid combines with borax dissolved in glycerine or acetate potassa.

Coagulation. - The conversion of many of the body liquids into a more or less soft and tremulous mass. The white of an egg may be coagulated by alcohol, alum, heat or any corrosive salts which take up the water which it contains.

Saponification.—When a putrefying corpse is exposed to water or in damp soil it may undergo a process of Saponification. Chemically speaking the fatty acids of the body substances combine with other body substances, such as ammonia, and form adipose.

Sapo is the product obtained by treating fatty bodies with caustic alkalies dissolved in water.

Anastomosis.—The phenomenal communication between two vessels. If the course of our body fluids be arrested, as by injury or disease in one vessel, it will proceed along other membranes as though the nerves were channels. The arteries and veins anastomose within the kidneys; also the pregnant uterus anastomose both arterial and venous blood with the placenta, and many of the synovia membranes exhale a fluid to all the movable articulations of the body. The synovia fluids resemble albumen or the white of an egg, and on analysis are said to contain water, albumen, soda, chloride of sodium (salt) and phosphate of lime. Synovian cysts are local enlargements, or they may include a form of dropsy in the synovian sheaths. *See page 113.*

Necros. - A cadaver.

Necroecia.—Funeral attention.

Necrocedia.—Embalming.

Necroscopia.—Examine, autopsy, or the embalmer's inspection of the dead.

Necropsia.—Post mortem examination after death.

Osmose, Endosmose, Exosmose, Collateral Vessels.

In considering the important question of a complete and practical collateral circulation being made throughout the capillary system by injecting the arteries, after they and the veins have had the blood drawn out of them, as by the use of the long silken catheter, is a matter which we desire our readers to consider as an item of the greatest moment of interest to all of them as embalmers. For while we may trace each artery to the smallest branches, where they diverge into the capillaries of the viscera and the deep flesh, do not be misguided into the belief that any embalming fluid can be put **through the capillary** by the use of a strong pump, no matter how much blood has been drawn from the veins or any parts of the body.

While to the uninformed this arterial and venous collateral circulation would appear to them as being easy and practical, but to a well informed anatomist all such delusive and illogical theories would pass as an empirical delusion of those who profess to make such embalming operations. Collateral circulation, generally speaking, means arteries and vessels branches which follow nearly the same course as the vessel from which they emanate. The blood vessels of the fingers and toes are called collateral vessels.

To consider the question of putting embalming fluids into the capillaries of the viscera, glands and the deep flesh, let us study the line of practical theories which the well known science of anatomy give us to day, not as theory, but as the well known and true facts, the word **osmose** (osmosis) means impulse, or the force by which fluids are impelled through moist membranes and other porous septa, by endosmotic and exosmotic action. What the embalmers should know, **endosmose** expresses the action by which *fluids from without to within* organic membranes *like the flesh cells and its tissue* and this is only by the *action of two fluids on each other* when separated by a membrane, and the general conditions of this phenomena are: First, that these fluids should have an affinity for the interposed membrane; and, secondly, that such fluids should have an affinity for each other and be miscible.

To go farther, as we consider the normal function of life, the process of Endosmose is varied in its time for accomplishing this transmission of those fluids, much in accordance to the nature of the septum or tissue, and of the penetrability of the flesh and body substances. Exosmose means the opposite to Endosmose, the chemical act, by which fluids are transuded, as from within the cells of flesh tissue to without that substance as by being extracted by some affinitizing substances. After death all of the

embalming emaciations do this as by alcohol, chloride of zinc, by the affinity for water juices of the flesh.

In speaking of a perfect Collateral arterial circulation ought to be accomplished in some favorable cases, but such an operation is not likely to follow the work of any empirical embalming anatomist, and if a complete and perfect collateral arterial circulation was ever performed since that idea seems to be prevalent in the minds of a few not skilled with a knowledge of embalming anatomy, there certainly would not be any black and mortified blotches to follow and show on the side of the neck, or on the more favorable members of that body like the hands, in the short time of a week after such an elaborate and wonderful process of embalment had been performed. The claim for a perfect collateral arterial circulation to be accomplished upon any deceased body in the short time of an hour or a day cannot be excepted as ever being successfully accomplished by any single arterial and venous operation, and while the author joins Renouard and Prof. R. W. Hussey in recommending the well known plans for removing the venous and arterial fluids as early and as thoroughly as possible, yet, as for anyone being able to force embalming fluid through the flesh capillaries into the veins is a preposterous and illogical theory, that is as false and misleading as those who profess and teach that class of doctrine as belonging to the true sciences of our modern embalming art. *See page 152.*

A Professional Technic Required.

In considering the question of Proper Technic, in this book, it is not my purpose to more than outline a few of the questions which require past, present and future synonyms. This is a question which ought to receive some attention, and it is one open for discussion, and no doubt some good things may soon be drawn out, when once this matter is taken up and discussed for the good of the profession.

The primary object of each case should be classed with a view of performing such embalming operation as may be determined upon before commencing the work for when we rate one modes of procedure there should be some specific object in view, and while it is true that the Egyptians had but three classes of this work, one of which was determined upon beforehand, the modern embalmer should also be able to determine upon as many classes of this art; yet, this should not be by any class of process, for a process is only that of a limited art which could hardly be rated as a progressive science. A process may be defined into two or more ways for making good leather or good soap, but a process can scarcely be made such as to conform the many intricacies of modern embalming into all that is now required of the embalmer as a strictly professional man. In order for us to more fully meet these new requirements, we ought to devise

ways and means by which to better denote not only the physical stage of putrescion, but we should also have words by which to denote the past, present and future of all that relates to the professional work in order that all operations may be made more methodical and scientific, as by Necropathology.

Destroying influence may be denominated as Past, Present and Future Stage.

Face appearance and other anomalistic words :

Neck and face—Distrolation, Distrolating, Distrated.

Thorax—Thorolation, Thoralizing, Thoralized.

Abd.—Abdomate, Abdomated, Abdomalized.

General appearance favorable.

Engormalizing, unfavorable.

Flesh decay should be more properly classed according to the substance matter, which causes various forms of body dissolution.

What the following words mean might be given by some better words, or an equivalent for them :

Express, Body Condition, Theoral and Special.

Many of the following words are thrown together in a peculiarly constructed way, more in hopes of drawing out, rather than as any suggestion :

Putrescinating.	Putrescinated.
Putrescing.	Putrescense.
Putrid.	Purilent.
Amonical.	Aminonical.
Abnoxious.	Amonolated.
Amonolating.	Abnormolated.
Abnormolating.	Abnormolous.
Fœticl.	Fetreous.
Fetromating.	Fetronated.

The disturbing influences should be classed to denote all the various stages of body waisting, decay, or Putrefaction, as by some definable Putremology.

Vegetable	Souring	Lactic
Fungus	Fermenting	Sporific
Bacillus	Thickening	Carbonic
Animalculating spores	Softening	Cadeavic
	Putrescing	Amonial gas
		Hydrogen gas

Result of Embalming Reagents.

Embalming plans, systems and methods, may be attained in various ways ; such as by rendering the flesh and body fluids neutral or chemically inactive, by some suitable equivalent element or substance that will correspond and harmonize all the

various body substances in a manner as by the following methods :

Dry	Emaciation	indefinite.
Evaporated	Coagulation	“
Emulsified	Saponification	“
Adiporcire	Glycomizing	“
Waxy	Balsamizing	permanent.
Granulated	Resonizing	“
Cohesion of Molecules	Crystalizing	oxadizing.
Solidificated	Petrifying	“

Embalment.

CLASS	METHOD	ART SCIENCE
Ordinary	Pallitive	Indeffinite
Carefull	Materially	Substancially
Special	Specific	Actually

Thermal and operation results that may be attained by Arterial, Cavity, or Anastomotic Embalmology.

Reagents.	Coagulents.
Anti-fermentum.	Petrifyers.
Oxadizing.	Sublimation.
Crystalizing.	Absorbents.
Amaciating.	Evaporating.
Drying.	Affinitizing.
Etherolizing.	Metherolizing.
Efforviscalated.	Non Superating.
Emulcilized.	Aromatized.
Granulized.	Saponified.
Glycerized.	Glycerified.
Waxinated.	Mumified.

The profession should have some more practical system for studying all that relates to Necropathology, and so be able to learn what are the best and most practical agents for their use in each specific class of Putrescion.

Crude embalming drugs and chemicals are variously composed of

- Salts as bases.
- Acids as bases.
- Sodium and compounds.
- Ammonium Hydrate.
- Potassium Hydrate.
- Calcium Hydrates.
- Nitrates.
- Difused gases.
- Chlorides.
- Chlorates.
- Sublimates.
- Salt liquors.

Metallic arsenates.
 Sodium and its compounds.
 Alum, salts, borates, chlorates.
 Balsams, resins, gums.
 Spices, honey and sweet granulations.
 Volatile or essential oils.
 Liquor, wines, alcohols, ether, aromatics and perfumes.

Some Putrifying Causes and Embalming Reagents.

The Ferments are known as alcoholic, acetic, and lactic fermentation. Putrefaction and the zymotic or morbid attack of infectious diseases.

Alcohol.—Methyl alcohol is obtained from distilling of wood or its smoke. It is poisonous and is used to dissolve resins, fats and oils.

Ethyl Alcohol.—Spirits of wine. It is made by fermenting glucose and distilling the product from grain and fruits. Absolute alcohol is a dangerous poison, and its use as an embalming remedy is because of its power or affinity for water; it hardens the tissue and coagulates albumen and similar semi-fluids of the body, it creates an emaciated and drying influence by an anastomosing effect throughout the body.

Essential Oils.—This will include all of the perfumes as well as such articles as oil of cloves. The trouble is to get strictly pure articles on account of the high price:

- Oil of Anise—Russian.
- Oil of Anise—Chinese.
- Oil of Bay, with Oil of Pimento, clove and nutmeg.
- Oil of Bergamot is cheapened with oil of sweet orange.
- Oil of Cade with common tar.
- Oil of Cajaput with camphor dissolved in oil of turpentine.
- Oil of Caraway.
- Oil of Cardamon with oil cajaput and camphor.
- Oil of Cassia and fixed oils.
- Oil of Cedar with Turpentine. The Egyptians used oil of cedar as a natrum to destroy the viscera and most of the flesh, leaving nothing of the body but skin and bones.
- Other essential oils are:
- Oil of Ceylon Cinnamon.
- Oil of Craton.
- Oil of Cubeb.
- Oil of Rose Geranium.
- Oil of Hemlock.
- Oil of Juniper Berries.
- Oil of Lemon.

Oil of Neroli.
 Oil of Patchouly.
 Oil of Rosemary Flowers.
 Oil of Sassafras.
 Oil of Sandalwood.
 Oil of Thymol.
 Oil of Verbena.
 Oil of Almonds.
 Oil of Amber.

The above essential, or volatile oils dissolve in alcohol and evaporate readily. Their uses as embalming remedies depends upon specific objects and purposes, only when confined to a fixed principal which requires the use of one or more of them for their anastomatic and volatile diffusing influences as emaciators and dessicators of the various body substances.

Drying oils, such as linseed oil, absorb oxygen from the air and soon solidify; while the non drying, such as olive oil, do not solidify, but they develop acids and soon become rancid. Chemistry tells us that acids and fats are the salts of fatty acids, while their base is glycerine. The most common of these salts are known as olein, found in olive oil, palmitin in the palm oil, and also in the human fats, while stearin is found in lard. The first is a liquid, the second semi-solid, while the last is solid. Though each one of these are variously subjected to various fatty acid rancidity, which is likely to follow into the rapid destruction of other body substances around them as they re-degenerate back to their primary salts and bases.

Scientific Embalming Operations.

Reviewing Operations may be performed upon the Arterial System.

Veinous System. *See pages 51 to 71.*

Cavity Operations.—Cranial cavity and Cerebral veins by operating through the inside corner of each eye space, or through the central nasal cartilage, or by another operation at the base of the skull behind the head. *See pages 132 to 138.*

Thoratic Cavity.—Operations upon the heart, lungs and around both these organs in the space of the pericardium sac, which surrounds the heart, and also in the plura spaces around the lungs. *See Pages 77 to 82.*

Abdominal Cavity Operation.—This operation should be made upon the stomach, transcolon, the bowels, kidneys, bladder, liver and the adipose, and if a female, might require special operations upon the uterus, while the greatest care should be observed in knowing that the trocar or needle point is sharp enough to puncture through the many reflections of the peritonium which surrounds the abdominal vicera, and in case that any

liquid infiltration or gases are to be drawn out of any of these cavities, watch that the instrument is not clogged up by the overlapping of some of these soft membranes. When such interruptions are too great, it will be better and safer to make an incision large enough to allow the gas or watery fluid to escape so as to avoid this further and possibly rapid destroying influence. *See pages 82 to 95.*

Areolar Space Operations.—Of the deep muscles and the lymphatics, the deep facie, superfacie, facie and epidermis. *See pages 133 to 137.*

The Embalming Agents.

The Affinitizers.—Comprises various drugs such as alum, arsenic, salt, corrosive sublimate and similar articles which possess a strong affinity for water.

The Saponifying Agents.—Are such as caustic, potash, and many other alkali products.

The Coagulating Agents.—Alcohol and some of the volatile ethers.

The Neutralizing Agents.—Comprises such salts or the compounds as will modify the chemical action, which may take place with a given substance under natural or some other supervening influences.

The Emaciating Agents.—Will comprise such drug solutions as zinc, arsenic, benzoin, corrosive sublimate, ammonia and similar drugs, which distract moisture or the flesh juices unto themselves by various diffusions, while dry air and similar causes create a dry and evaporating influence, and so in this measure destroys all putrefying processes as soon as all moisture is removed.

The Anastomosing Agents.—Comprise all the flesh permeating agents; such as some of the essential oils, ethers, chloroform, alcohols and any other liquid or vapor medium that will carry a drying or neutralizing agent throughout all the body substances, and so create such a diffusing influence as to destroy all putrifying stages throughout every portion of the deceased body with the permanency of a true embalment.

Experimenting with Cheap Drugs and Their Compounds.

Under certain proper and theoretical circumstances there may be quite a number of varieties and classes of cheap drugs that may be made use of as the most available for embalming the various classes of diseased bodies, to which each drug or its compound may be adapted because of its possessing some true remedial property, which may fit it into a place of value as an embalming agent.

But I do not mean to say that cheap drugs can be thrown together in any class of compounding, other than by some systematic rule known to the true science of pharmacy. When certain drugs, which possess a given property that is known to be useful under certain laws of cause and effect, and so may become useful to the embalming art, under the same law and by the same methodical rule as in that science which, for one or more purposes, has denominated its quality and uses as a proper remedy of any class of embalming, or in fact any other class of drugs or chemicals have any place in the embalming *Pharmacopæ*; that place must be given to them by a strict demonimated class to which each one of them may belong, and if one of these drugs has any known property which may class it as an embalming reagent, which will remedy any class of Putrescions. What class, or what disease, and what body physique is it best adapted to, are the questions which we must know, if a true and unwavering remedy? For one drug, or in fact no compound of several drugs, can and will remedy all classes and condition of subjects, and it is no more reasonable that they should do so in embalming the dead than for any drug to cure all diseases, or to be applicable to all varieties and uses in any of the other arts.

Necrocedial Remedies.

Specific compounds for general specific purposes and uses may be excepted as will be spoken of elsewhere, because some of our well known and responsible proprietary embalming fluid preparations are to be classed from what has been known of them by so many years of their uses, when in the hands of experienced and progressive embalmers. (*See reliable embalming fluids.*) But to deal properly with the unknown compounds which are so common all over this country, it is scarcely necessary for me to say that the time is here when the embalmers should begin to consider what they buy and use, much in accordance to the source that such articles come from, as well as to know of the personal

qualification of those who profess to understand so much about the sciences of chemistry, and the true laws that stand behind the strange phenomena of all class and conditions of Necrosal embalmment.

Preparations That Are Injurious Instead of Useful.

All intelligent people should know that by the first law principal of all drugs, one chemical is made more or less combatable with even the air or some damp vapors, while two or more drugs put together may become more or less dangerous, because of their primary products, which may combine in various ways so as to destroy themselves, or something else that may be near to them, and for either cheap drugs, or any other classes of drugs, to be compounded by any supposable embalming formula, or thrown together for the embalmers' use by any one who is not strictly conversant with all that relates to the sciences of the known pharmecutal history of each of the element proportions which each drug may possess; and to go farther, how do these adventurers know what specific part of either one of these primary drug products may be made useful as an embalming remedy, in any given case, or under any given cause or circumstances, whatever?

While if we go still farther, what can self-professed men know about the various properties of injury these so-called discovered drug compounds may possess, and in fact is it not more probable that for each single case that may be benefited there will be ten to one hundred cases that are injured, and possibly destroyed. And when we take away the name from such fluids there will be nothing left of such compound to recommend its use as an embalming remedy, or it is not true that they are sold by name and not on what they merit.

True Remedies.

All professional advancement must come by the work of study, and the application of the industrious class of men who so ply themselves to only the true professional methods by sturdiness and candor, and it is not the work of a true profession which supplies formulated mysteries by any way or class of secret discoveries.

If cheap drugs have any place as embalming reagents, the true history of each one must be brought to light by dealing with the actual chemical properties, which each one of these drugs may possess, and this in just the same way as the proofs are made for establishing any other class of drugs or pharmaceutical preparations that are made as the specific remedy for any class of disease or other purpose.

The fact that a drug or any other compound is high priced gives it no value as an embalming remedy, and the fact of knowing that a preparation possesses fifty or more ingredients would

also disqualify the compound in the mind of any one who knows the first law principle of chemistry, but there has been not a few men who profess to do a little embalming who have been induced to believe that such and such compound must be quite wonderful in its mysterious working power as an embalming fluid, and what all, who study to learn the modern and practical way of embalming, should know is that neither the high price of drugs nor the endless variety of drugs that may be thrown together are to be considered of any practical value or use to them or anyone else for uses in the treatment of any class of cases to be embalmed, but all true embalming science and its known and established acquisitions must be made such by men who are also known to be both qualified and truthful in dealing with what relates to experimental tests and their opinions as they define any class of drugs into any classes or uses as embalming remedies for either special or general uses. Then when other men of like experience and conservative discretion may further establish and show by some practical proofs that such drug or its compound do possess such chemical properties as will qualify them in some way for the the embalmer's uses as embalming remedies, then this proof should be further established by a long line of other proofs that relates these evidences to what can be shown to other men who are skilled in the art. But what other men may say or believe should be rated and classed as the opinions of inexperienced men, and while it may be true that empirical observation might make some good discovery, or say something which might lead others directly to it, yet our profession should learn to be more cautious in the future as to what they may say or do in regard to their practices, and what remedies they may use until they have rigidly established every claim by the most exacting proofs from the most professional and practical standpoints which may be given by men of a professional standing.

Cheap drugs do have many valuable places in all of the arts, but such place is given to them only upon the most practical and simple, yet by the most scientific laws, which each drug or its compounds are made into as the available remedies for so many and varied purposes, for not only the common uses of men, but for the highest place and uses in all art science, to which capable and gifted men of the known science of chemistry have proven and adapted them to various useful place, because of the primary elements, which, in various ways, have been shown to adapt them to some specific result, and this is done by these men through the carefully studies laws of cause and effect, and as this has been true in medical pharmacy, and so, perhaps, many of these simple and cheap drugs may yet take some grand and useful places as the embalmers most scientific and available remedies for at least a fairly good part of their professional work, but our profession will do well to see that all their embalming fluids are made and brought out by men qualified in all that relates to the embalming pharmacy.

Review of Body Dissolution and Remedial Methods.

In considering the general consequentive results of diseases or any other death causes, it may be shown that the combined Necrocedial results, as they may and in fact always are, caused by the actual physical substances which each body may contain at the time of death, and so these body substances in various ways, may thus become putrifying infusions, which is more or less peculiar to the body substances, which the oils, fats, and other flesh liquids of the body may produce; and as the oleine and similar fluid substances sours the oil becomes rancid. While the albuminous matter foster the putrescing stage when amonical gasses will thicken and swell the fatty cells, and so break them down into the watery state when other gasses like sulphuretted and phosphuretted hydrogen gas will form and impregnate every flesh tissue of the body.

I regret that space will not permit my giving a detail instead of a limited outline of Bacterial Chemistry, and by this show how many forms of dissolution there are known under various heads of well defined germ theory, but to show the prevailing condition of the putrofyng body fluids as they are found.

The blood always separates into two or more substances. When the Fibrine goes into a clotted mass with a clear liquid over it there will not be the blackened face for some hours, or even days after death, like there will be at such times when the acidity of the fluids take place so rapidly as to dissolve the fibrine more or less, and so create an echmosis or inkey condition of blood, which takes place so soon after death in both the ascending and descending vena cava. The proof of this condition will be shown by pressing the thorax when the face will blacken; should this fail try a pressure upon both the thorax and abdomen. Page 81, from Gray, published in the May, 1893, number of the Embalmer's Monthly, showing the veins of the head and neck, and it only remains for me to say that the more robust the physical condition are in at the time of death the larger will be the veins and arteries. while by the side of this comes the fluid and fats of the Lymphatic system. *See page 76.*

The February number of the same monthly illustrates Renouard's system for withdrawing the blood from the region of the heart by means of a silk catheter being introduced into the left Brachial vein, and this simple operation for introducing the

catheter clear up to the heart has many admirable points. Yet there still remain so many hindrances, for while in some cases this echmosis or black fluid may be all removed, there are other cases where solid clots of blood or vein ruptures will not enable the operator to get in the vicinity of this venous blood by this operation.

Black Faces Caused by the Thickening of the Viscera.

During the seventies I wrote out a plan which the *Casket* published, and through the columns of the same paper, during the summers of '80, '81, '82 and '83, I gave it as my opinion that when the trocar or canula needle, after being forced into the heart, failed to remove this black fluid, it was because of the thickening of the cells of the viscera, and this was caused by a state of fermentation. and when so far advanced as to press upon the walls of the thorax, or when no blood or gasses are free there may be some engorgement of some portion of abdominal viscera which may press all of the blood upward and outward, and so cause the face and surfaces of the body to appear black and mortified. In such cases as this either the trocar or needle ought to open up the swollen parts so as to remedy the case and make room for the inky blood fluid inside of the trunk of the body, but should it still do so a liberal use of both the knife and the long exploding rod may be necessary in order to obtain good results by quick methods. In handling both children and adults of large and fatty physique it is always necessary to watch that the fluids, which are being injected, do not displace the black venous fluid that has settled into the thorax, and so cause it and some of the light gasses to raise into the face; or it may do so at the time or a few hours afterwards. Though it may be said that this will happen at such times as when the arteries only have been injected. If the veins had been injected properly the embalming fluids would have coagulated the inky fluid, and so prevented much of its being in any floating and gaseous condition.

Obstructions.

We must always consider the question of abscesses blood clots and ruptures, and a disregard of these conditions are the principal causes why one case failed to do as well as one that was operated upon in exactly the same way. For in cases of these and like obstructions the embalming fluids may all be placed in some side cavity like a pocket, and when it does so the chemical, no matter how good it may be, can not enter into contact with those primary gasses which is designed to destroy by its chemical uses.

Instead of chemically acting upon the sour fluids of the body, it takes space, which the swelling organs of the body require, and in the operation the face and neck gets black and puffed up out of shape. Now as we have a good point for a lesson, the ruptured

artery or the blood clot are two causes for losing the case, while the third one may come by reason of our own work, so there are three causes instead of but two.

What shall we do? The quick way is to use the knife and open the chest, so that the veins may be cut off. Split the lungs only after injecting the arteries and lungs full of embalming fluid through the trocar. I prove my work by slight cut at the extremities of the arteries, say between the fingers and toes, when the pump will show whether the arterial vessels are ruptured or clogged up.

Should the engorgement of the abdomen require opening do not fail to use the knife liberally. But first try to aspirate the organs thoroughly, and so free them of their fluid or gaseous contents, should this be the cause of the abnormal condition. When all ordinary injections of the cavities or arteries fail to do the work in time, then it has been my invariable rule to make such deep incisions as the case demanded in order to first get at the very seat and causes of cadaverical engorgement. By this means it will then be easy to remove the sour fluids of the body at such times and places when no embalming fluid can be made to reach the local or general disorder, and then by a liberal use of the embalming fluid and drugs the viscera will settle down and remain free from further putrescing engorgement. So use the knife freely, but judiciously.

Theoretical and Practical Embalment

The embalming operations should be simple and rendered complete by a thorough knowledge of the physical condition which each subject will present, otherwise no one should undertake this important work until they become thoroughly acquainted with the human structure and the various abnormal condition to which each organ of the body may become involved with by local affection, which must be obviated by the various methods and processes known to the art.

As rigor mortis will hold a vascular rigidity of the vessels during a few hours after death, it is best to await this muscular relaxation before undertaking to inject the embalming fluid. But during the last few years it has become customary to call the embalmer at once after death and by this very good work can be done before rigor mortis take place. In cases when the body is very large and fleshy there will be more or less troubled to raise many of the arteries which the surgical illustrations show, but the brachial, femoral and other arteries of the limbs, may be located and raised with but little trouble, provided we use care to locate the vessel, and then in making the incision so as to not cut them off, and so possibly lose the vessel we desire.

Black Faces.

Bad Case.—When the vein and artery are securely connected to the artery tubings we may inject vaporous solution, made by putting alkali and soda equal parts into the bottle, and then turn some liquid ammonia into the bottle, and use care to weaken the solution with water so that it will not be too strong; then inject this into the veins and arteries. I sometimes use one-half gallon or more in order to soften the veins and arteries and dissolve the blood clots and then draw it out.

I would say repeat the operation and make the proofs show that the arteries are not obstructed until the fluid runs clean and white, then inject the arteries and veins as full of the embalming solution as possible, varying in quantity according to the size of the body. Yet some subjects will require more fluid than others, but I want not less than from three to five pints of fluid to the adult.

Working Proofs.

It is not best to try to force the injection at any one place, because better work will result when the vessels receive the fluid with but little pressure, for as a rule the hand bulb syringe will be all that is necessary to inject it, and when the toes and fingers be cut to show us small streams of fluid passing we may feel more confident that the arteries are not ruptured. Yet this will be no indication that the kidneys and other organs of the body will also receive a like proportion of the embalming fluids.

After an hour or so more fluid may again be injected into the veins and arteries—in fact it will be better to continue this operation for a day or so, when circumstances will admit of it. In case we do not feel safe to risk the embalming fluid you have taken 5 oz. of chloride of zinc, 4 pints of water, 2 oz. hydrochloride solution of arsenic, 1 oz. salicylic acid, 1 pint of alcohol, and after drawing out as much of the body fluids from the arteries and veins as possible inject this solution. When in the course of an hour or so small mottled spots will show upon the face and other parts of the body and finally settle down, and then the flesh will become firm and dry.

In all cases where marks of any enlargement are shown with either the thoracic cavity or the abdomen, the aspirating needle should be inserted in such a manner as to draw out the pus fluid or gases which may be likely to be the cause of this enlargement before filling the arteries with the embalming fluids. (*See Figs. 27, 28, 29, 31.*)

As there are so many causes of death, the embalmer must study each of these or run his chances of losing a subject by some oversight. While a general system or process may do for a large per cent. of deceased bodies, there are many classes of subjects which will require more than a special treatment of cavity injections. Experience proves this to the extent that special post

mortem operations will be found necessary in order to remove the abnormal organ or the seat or local difficulty that to begin with is the cause which sooner or later endangers the whole system of that body to such an extent that it will go to pieces by reason of its poisonous gasses. Kidney troubles, inflammation of bowels or of the peritoneum (*See Fig. 31*) and several similar diseased affections of both the abdominal or thoracic viscera. These are each subjects of the greatest consequence and they must be dealt with in the most thorough way by either removing these organs with the knife or locating them accurately and then introducing the trocar or exploring tubes and injecting them with the strongest fluids. The stomach, lungs, liver, kidneys, bladder and intestines should each be injected and washed out, while pregnant women, in the advanced state, must be especially treated. (*See Plates 2 and 3. Fig. 36 and 37.*)

Brain Removal.

The brain requires more or less attention, according to the case. Prof. Renouard introduces embalming fluids into the brain by means of a short strong tube, inserted through the corner of the eyes—in fact by removing the eyeballs part of the brain may be drawn out with a hooked rod. Another way is to drill a hole through both ears, by coursing the point of the instrument well upward as it goes into the head. The best way is to raise the skin on the side of the head by a long flap about an inch square, then turn the flap back to the ear, trepan the skull and draw out all the brain, fill up the space with sawdust and dry arsenic, then inject the embalming fluid and close up securely. When the hair has been prearranged, the wound may be fully covered up. I gave a plan some eleven years ago through the columns of *The Casket* for removing much of the fatty deposits from the abdomen and from under the muscles of the limbs and around the trunk of the body by means of long iron hooks and probes, and my plan in treating very fleshy subjects is to inject strong embalming fluids under both the muscles and the deep and superficial fascias. With this operation we will be limited to the places which are first opened by the probes and exploring rods, but after this is well started a strong pump will send the fluid over a considerable surface of all such places as the needle can be inserted into far enough to close the space around the needle shaft.

Treatment of Adipose and Morbid Growth.

When there is a large quantity of abdominal fats or adipose, this should be removed when possible to do so, otherwise I would gash it open and let the heat out, then treat the whole subject with dry arsenic and caustic soda. The deep flesh of the thighs will also hold heat in a corresponding manner. In order to stay the decomposing tendencies of the flesh juices as they take on the souring or rancid process, this animal heat must be stopped as

quickly as possible, otherwise the fluids of the whole body will become enworked by the volatile fatty acids and similar animonical compounds to that extent where nothing short of putting the body into a vat of emblming brine or solution will stop the rabid elements of body dissolution, because of the spontaneous outburst of nature's element, putridity and decay.

I find that it will not be possible for me to enumerate all of the known chemicals for embalming this body and keeping it as a specimen of the art, especially that class of bodies which Plate I shows. If I should attempt to reason out the specific requisites of each drug and how and why one class was especially adapted to the uses for embalming certain cases, and why they were unfit for another class, it would take far too much space, as well as to add no end of confusion to those who know but little, if anything, about chemistry. But the time is not far distant when all embalmers will study special classes of chemistry and by this means will be able to treat all cases by methods governed largely by physical signs and conditions, and the writer will be very glad to discuss all such questions after they have thoroughly studied the long line of death-ending causes which we have given in this book, and those who desire may address the author, care of the publishers of this book.

What I would impress upon the minds of all who have interest enough in the subject of progressive embalming is that the embalming art is a progressive science and one that will yet become much better established by fixed principles of chemistry and by methods of embalming operations, for it is true that as the physical conditions, within a class, when coupled with diseases of certain classes, become subjects for special treatment, and thus one now becomes involved with so many intricacies that the embalmer's observations and former experiences only can find ways and means by which to finally master the situation, as may be required of our profession, for it will only be by the most philosophical reasoning that any one man's work may be shown and established as being better than that of others equally experienced. Yet if this be true, and we know that it is in all questions of medicine and surgery, why not so with embalmers also?

Then if we look about us we may see the first steps toward a true methodical advancement in the embalming art, as it will then be a fact that it has began. When all experienced observations will be brought together upon common laws of cause and effect by those men who become so profoundly broad minded as to throw away all craftiness because of a love of that truth which alone can make the embalming art scientific.

Aspirating the Blood fluids.

In performing operations upon the arteries, veins and trunk cavities for the purpose of drawing out the blood and other fluids from the body, the question of making that operation successful depends largely upon several primary conditions. The first is, to get more or less directly in contact with the body fluids that are to be removed, and in order to be able to accomplish the successful removal of any considerable amount of the body fluids, this will depend upon the location of those fluids, this condition and the condition of the arteries or veins and all such other cavities that contain them, for if the blood is clotted around the vicinity of the heart, the clotted fibrine must be softened and made liquid enough for the pump or the aspirator to carry it out as fluid; dry blood or fibrine will not follow the vacuum of the pump, and in all cases when the blood is thick and stringy, some diluted acetic acid should be injected and given time enough to soften the blood clots and this is also true when the vein walls have dried and adhered together. Vinegar would do for softening this dry adhesion of both the blood clots and the veins, and also soften the blood contents of the collateral arteries and their smaller branches. Care should be taken to remove all the vinegar or acetic acid solution by washing out all the cavities and blood vessels that may have been filled with these sour fluids.

Liquor Ammonia or ethal alcohol is the best for all classes, and especially the last when it can be afforded, and several washings may be necessary in the large plethoric subject. There are several embalming fluids which will soften the blood and loosen up the veins that may be adhered together. *See page 132-6.*

Body Vents Must Be Made.

When an incision has been made to parallel the flesh of a dead body, usually there will not be any watery fluids that will escape for some considerable time afterwards, though as the stages of body dissolution becomes advanced, it will be found that such wounds will throw off more or less amounts of its flesh juices. When the wound is made across the grain of the deep flesh, watery fluids will usually follow this kind of an incision quicker and more abundantly than with the first operation, and the reason for this is that the knife has cut across many of these fluid channels, while the first cut only paralleled a few of those

channels, if any were cut open, so that the flesh juices could escape.

When the trocar or needle is forced into the ordinary body, it is doubtful if any amount of the body fluids will run out, or may even be pumped out with either the syringe or aspirator, and the first reason is because there is no vent to let the internal fluid substances follow the vacuum of the pump.

If we press the body some fluid would flow out of some of the incisions quite in the same way as the contents of the stomach or lungs would be made to purge their fluid contents.

Needle Obstructions.

Body gases would escape if the exact cavity was punctured ; If not, this pressure might cause the stomach and lungs to purge. In fact, these gases might press so hard as to burst the soft glands and other tissues of the mouth and nose, and yet not let any blood or other fluids escape through the needle, and one of the reasons for this is that the needle is not located in any vessel or cavity where the fluids are located, and another reason is that should the needle be in the right place, some soft, flexible membrane might be drawn up tightly around the mouth of the needle, and so prevent both gas and fluid from passing. Air might be pumped into the cavity or vessel, and the soft membrane would still prevent our getting either the fluid that is reserved or even the air that had been forced into the body and this, as has been said, on account of the floating nature of many of the soft internal membranes that wrap themselves around the point of the needle, and thus prevent our drawing out much of the blood and flesh juices of the body.

Open Vents.

Artery tubes, canulas and trocar points must be well and liberally distributed, and then there will be some cases that will not give up the body fluid as they should do by the use of the strongest pump, and this will sometimes occur even after the most liberal use of artery tubes and the canula vents have been carefully placed. After this operation there is usually no trouble in pumping fluid through the smallest arteries when these vessels are not too badly clogged up or ruptured, but if we reverse the the operation and try to draw out the fluid that has been put into them (and now much of the fluid that was put in the body cannot be again recovered, as the pump will not bring it back), it is easy to see how this may be caused by the flexible and soft sides of the veins falling together and drawing tightly around the point of the tube when the fluid is put into the veins, but in the arteries these vessel walls do not collapse as the veins do, and so this leaves the artery tube free and open, so where is the cause that keeps us from drawing out all of these fluids which were placed into these arteries.

Capillary and Molecule Affinity.

To answer this question we will say that the capillary attraction of the flesh substances take up some of it—capillary affinity—and the coolation of the fluid molecules become allied together, as one molecule of water holds on to another until air separates these molecules, and now, as the air is excluded by the vast region of the small artery branches. One vent, and in fact a dozen vents, are not sufficient to let the vacuum of the pump or syringe take it away from its common affinator of the flesh, as within the remote artery branches and capillaries of the deep flesh and the various membranes of the body.

Hand Working and Rubbing.

If all blood and flesh juices of the deceased bodies could be extracted by the pump and canula as completely and perfectly as it now seems ought to be accomplished, how easy it would be for us to learn how to make and perform such operations, but while the theory is good, and no doubt quite correct, but we must know and learn to master at least some of the many intricate disadvantages which will always surround every individual case. The vent theory is one of the best, but the fact that an artery or vein may be opened at two or more places will not always provide a sufficient vent, and in such cases it will be found to give a good result if a liberal vent is opened up to the adjacent cavity of either some organ of the viscera, or what may be found more beneficial may be found in both the thorax and the abdominal cavities by means of some tool which will hold the walls of the overlapping flesh membranes well apart, then by using alcohol or some other softening drug, and by working and rubbing all the flesh surfaces much of the body fluids and flesh juices may be worked and drained out more or less quickly and satisfactorily, when the body ought to be in a much better shape for receiving the embalming fluids.

I use Ether for destroying the fats and oils of the body by injecting the strongest solution into the arteries, veins, cavities and the areolar spaces. After an hour or so the ether may be pumped and worked out by hand rubbing all parts of the body surfaces. Follow this by injections of alcohol in the same places, when, after a few hours, this alcohol may also be renewed several times if necessary. This will take away much of the water from the flesh. Then use the embalming fluids that possess the least water. *See Reliable Fluids.*

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